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North Carolina Department of Transportation  
Statewide Planning Branch  
Systems Planning Unit

# TRANSPORTATION PLAN TECHNICAL REPORT

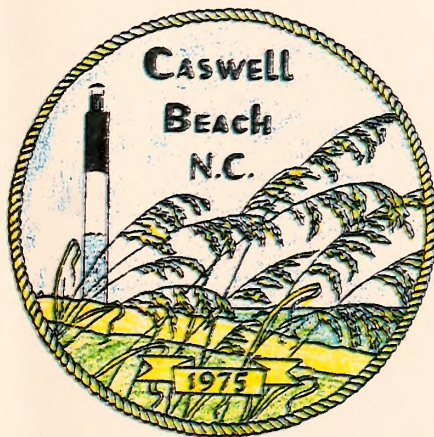
for

## OAK ISLAND

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Town of  
Caswell Beach




Town of  
Long Beach



Town of  
Yaupon Beach

August, 1998



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**Thoroughfare Plan Study Technical Report  
for  
Oak Island, North Carolina**

Prepared by the:

Statewide Planning Branch  
Division of Highways  
North Carolina Department of Transportation

In Cooperation with:

The Towns of Caswell Beach, Long Beach and Yaupon Beach  
Brunswick County  
The Federal Highway Administration  
US Department of Transportation

August 1998







## Acknowledgments

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Special thanks to the officials of Caswell Beach, Long Beach, and Yaupon Beach towns for their foresight and drive in developing this plan. Also, thanks to the Southeast Brunswick Sanitary District, Brunswick County Planning Board and Board of Commissioners for their assistance and commitment to long-range planning.



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## EXECUTIVE SUMMARY

### Overview

In April of 1995, the Town of Long Beach asked the NC Department of Transportation (NC DOT) to review their highway system and update the thoroughfare plan for the town and surrounding areas. In May of 1995, both Caswell Beach and Yaupon Beach were added to the study. The primary concern was the increase of visitors in the region during tourist season and how this increase might impact the existing transportation system.

### Highlights of the Thoroughfare Plan

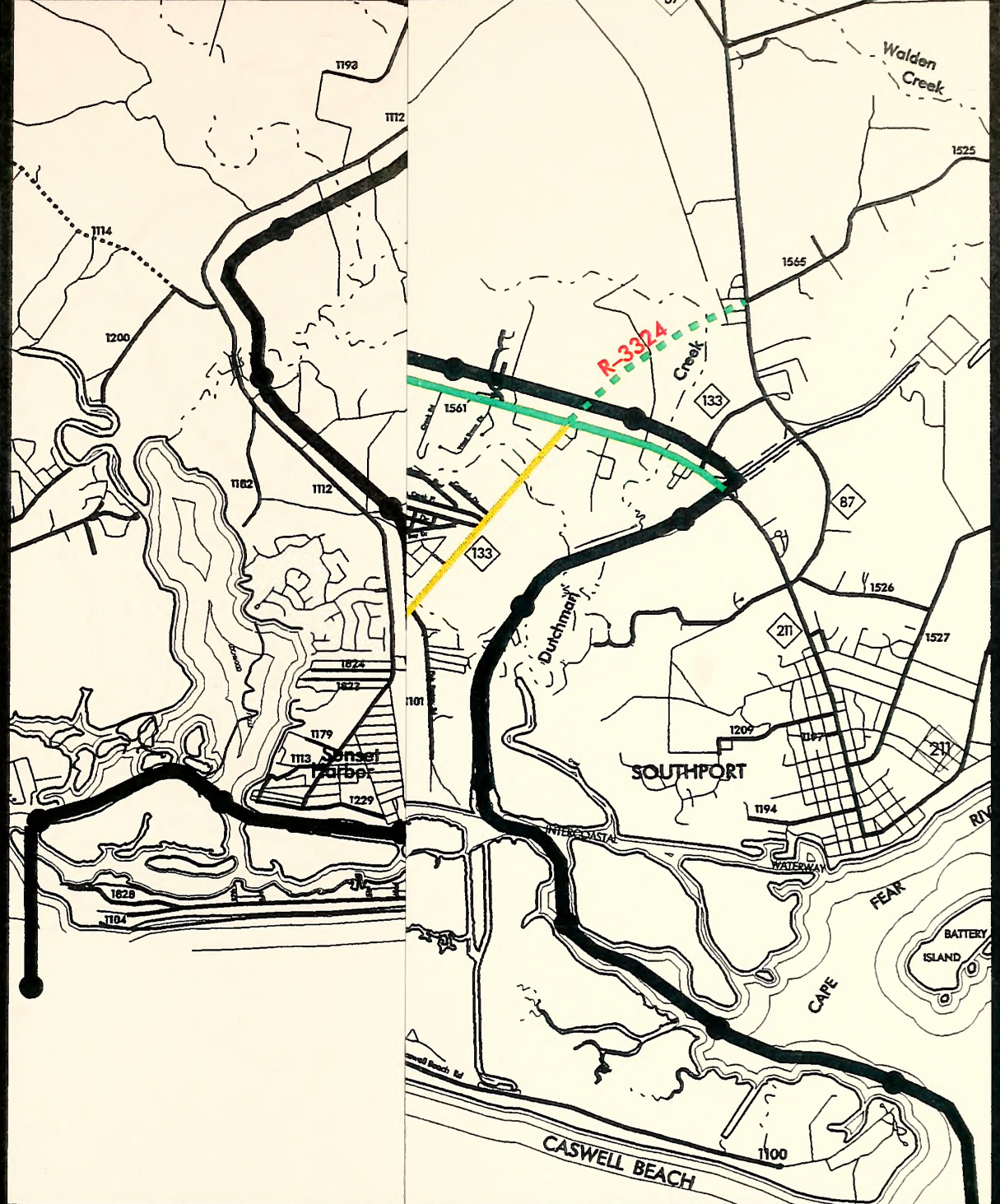
The Oak Island Thoroughfare Plan has been mutually adopted by each town and by the NC DOT. This report is to present findings and recommendations of the thoroughfare plan study. Major recommendations of the 1996 Oak Island Thoroughfare Plan are outlined below and shown in Figure 1. The adopted thoroughfare plan is shown in Figure 2. Project numbers for those projects included in the 1996-2002 Transportation Improvement Program (TIP) are shown in parentheses.

- 1) NC 133: widen existing roadway to five lanes from NC 211 to Old Bridge Rd.
- 2) NC 211: widen existing roadway to four lanes from Midway Rd to the eastern planning boundary.
- 3) SR 1190: widen existing roadway to three lanes from 29<sup>th</sup> St to Middleton Rd. Traffic will not warrant a four-lane section during the planning period.
- 4) Doshier Cutoff Bypass: widen proposed route from NC 133/211 to NC 87/133 (TIP #R-3324) from 2 to 4 lanes.
- 5) Second Oak Island Bridge: construct a second bridge to Oak Island, from Beach Drive to NC 211. Middleton Avenue from Beach Drive to Oak Island Drive will be widened, Bridge # 206 will be replaced over Davis Creek on Middleton Avenue, and a two-lane facility from Middleton Avenue to NC 211 will be constructed on a new location. (TIP #R-2245)

Refer to Chapters 4 and 5 for recommendations for Bicycle Accommodations and the Airport Master Plan.







**LEGEND** WIDENING

2 LANES —

3 LANES —

4 LANES —

5 LANES —

DRIVEWAY ACCESS IMPROVEMENT

PLANNING AREA BOUNDARY

TIP PROJECT NUMBER ■

**FIGURE 1**

**RECOMMENDED**

**IMPROVEMENTS**

**OAK ISLAND**

**BRUNSWICK COUNTY**

**NORTH CAROLINA**

PREPARED BY THE

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

**STATEWIDE PLANNING BRANCH**

IN COOPERATION WITH THE

**U.S. DEPARTMENT OF TRANSPORTATION**

**FEDERAL HIGHWAY ADMINISTRATION**

Base Map Date: February 3, 1997







**LEGEND**

	WIDENING	NEW FACILITY
2 LANES		
3 LANES		
4 LANES		
5 LANES		
DRIVEWAY ACCESS IMPROVEMENT		
PLANNING AREA BOUNDARY		
TIP PROJECT NUMBER		

R-0000

October 28, 1997



**FIGURE 1**  
**RECOMMENDED**  
**IMPROVEMENTS**  
**OAK ISLAND**  
 BRUNSWICK COUNTY  
 NORTH CAROLINA

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### LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

## FIGURE 2 THOROUGHFARE PLAN OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

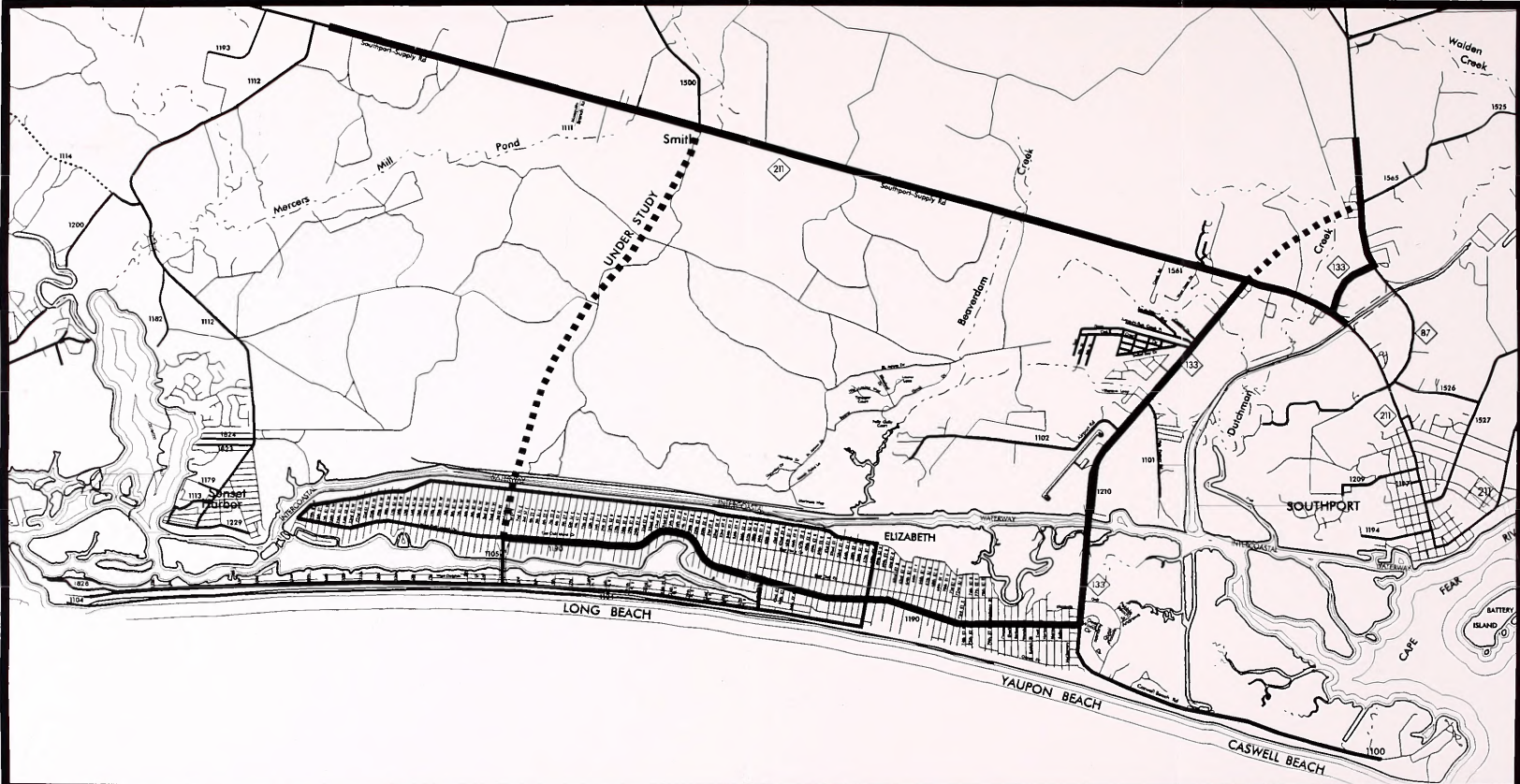
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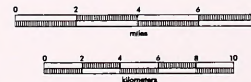


## LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

CASWELL BEACH	February 12, 1998	November 13, 1997	
LONG BEACH	January 20, 1998	January 6, 1998	January 20, 1998
YAUPON BEACH	February 9, 1998	November 10, 1997	
RECOMMENDED BY STATEWIDE PLANNING	March 12, 1998		
N.C. DEPARTMENT OF TRANSPORTATION	April 3, 1998		

October 28, 1997



## FIGURE 2 THOROUGHFARE PLAN OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

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## Chapter 1

### INTRODUCTION

The Oak Island area has existed since the mid-18<sup>th</sup> century, beginning with the construction of Fort Caswell in 1820. Construction of a bridge over the Waterway in 1975 kept the island inhabitants in touch with civilization after the Intracoastal Waterway was constructed.

Yaupon Beach dates back to 1952. Four hundred building lots adjoining Long Beach were purchased by the firm Barbee's Incorporated from the Middleton family and became incorporated in 1955. The Oak Island Golf and Country Club and the surrounding residential properties were annexed by Yaupon Beach in September 1973.

In 1975, the residents of Long Beach and Yaupon Beach were discussing consolidation, working toward a merger referendum to be held in March, 1976. Yaupon Beach wanted to annex the land located between the NC Baptist Assembly and the Oak Island golf course. However, Caswell Beach originated (December 15, 1975) within this desired area due to a perceived need to keep their individuality.

Long Beach existed before Yaupon and Caswell Beaches. E.F. Middleton and his son founded Long Beach. In November 1968, as president of National Development Corporation, Middleton, Sr. donated 30 lots to the town for use as a public park (now known as Middleton Park). A plan for consolidation of Long & Yaupon Beaches was halted by commissioners in April 1975, and a negative vote in March 1976 of Yaupon Beach voided the merger issue with Long Beach.<sup>1</sup>

This thoroughfare plan study considers the concerns of each town in addressing the patterns of future growth. Thoroughfare plans are created to insure transportation system efficiency development through a cohesive, coordinated system of roads and highways. The report documents the basic thoroughfare planning principles and procedures used in developing the recommendations. Chapter 1 provides an introduction to the study. Chapters 2 and 3 discuss traffic trends and other issues affecting transportation in the area, as well as the traffic analyses conducted. Chapters 4 and 5 provide detailed descriptions of the study, bicycle, and airport recommendations. Finally, Chapter 6 covers the benefit/cost analysis of major projects.

---

<sup>1</sup>The information for the history of Oak Island came from "The History of Oak Island", *The State Port Pilot*, Spring 1995. Other data from this composition has been used throughout this report.



Further information is provided in the Appendices. The complete Thoroughfare Plan Street Tabulation and typical cross sections, including detailed recommendations, are contained in Appendix A. Appendices B and C address the thoroughfare planning principles and different methods by which the recommendations can be implemented. Environmental concerns considered in the development of the plan, and an overview of the involvement of the Towns and the general public in the development of the plan are shown in Appendices D and E. Recommended definitions and design standards for subdivision ordinances are listed in Appendix F.

The recommendations are based on general traffic, population, and land use data. Year 2025 average daily traffic projections were used to determine capacity deficiencies. Major and minor thoroughfares were located based on existing and anticipated land uses, field investigation, and topographic conditions. A geographic location of Oak Island is shown in Figure 3.

The North Carolina Department of Transportation (NCDOT) and the towns of Oak Island are jointly responsible for the proposed thoroughfare improvements. Cooperation between the State and the towns is of primary concern if the recommendations outlined above are to be successfully implemented. The plan has been mutually adopted by both parties, and it is the responsibility of the towns to implement the Plan following the guidelines set forth in Appendix C.

The adopted thoroughfare plan is based on anticipated growth of the urban area as currently perceived. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.



# GEOGRAPHIC LOCATION MAP FOR OAK ISLAND

(Caswell Beach, Long Beach, and Yaupon Beach)

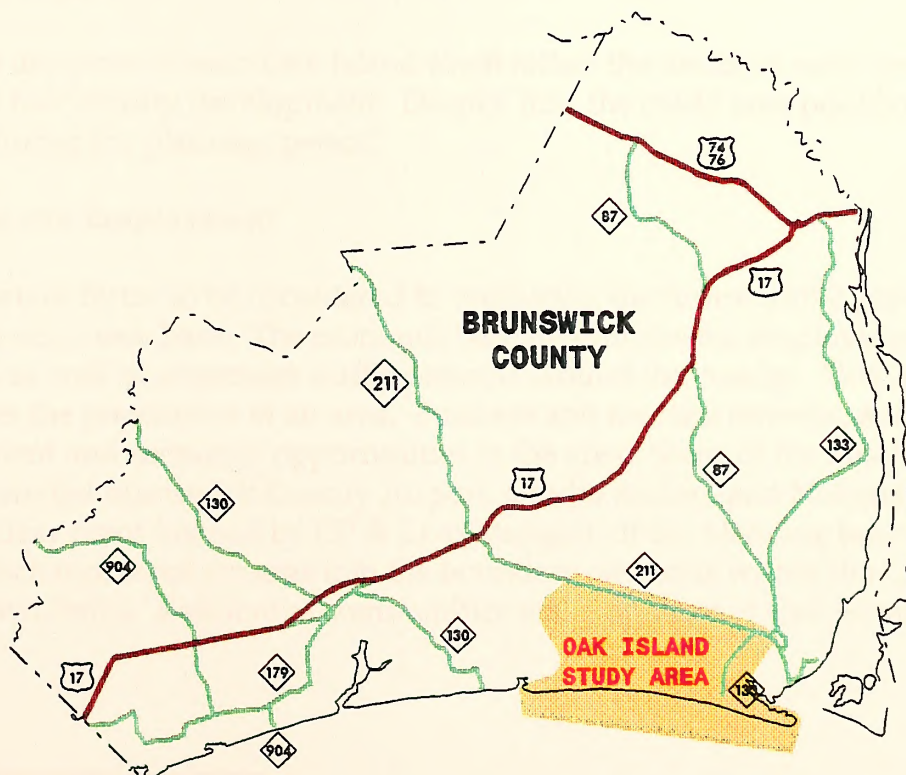
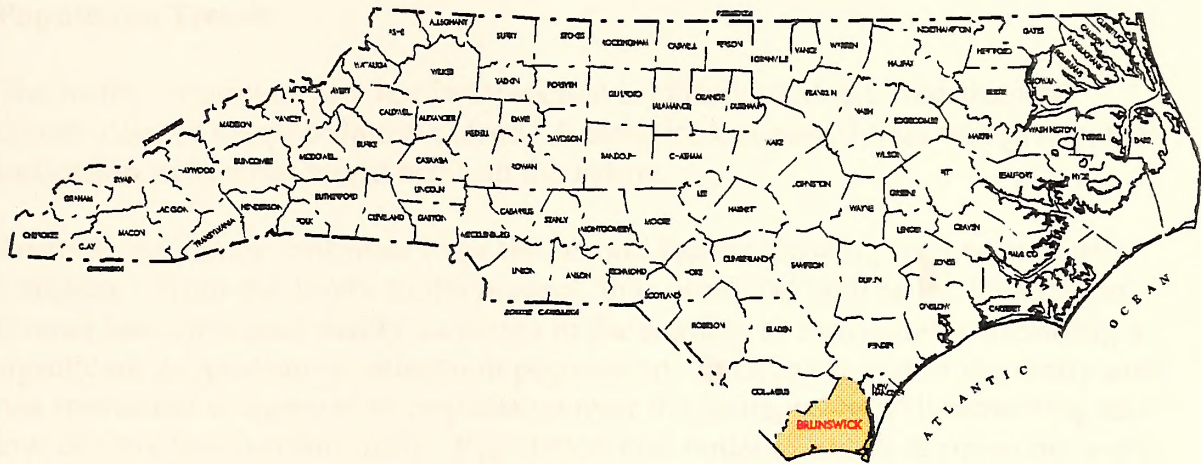


FIGURE 3





## **Chapter 2**

### **TRENDS**

The objective of thoroughfare planning is to develop a transportation system that will meet future travel demand and enable people and goods to travel safely and economically. To determine the needs of an area, it is important to understand the role of population, the economy, and land use.

#### **Population Trends**

The traffic volume on any roadway section is closely related to the size and distribution of the population served. A close look at past trends will give some indication as to what might occur in the future.

Brunswick County continues to be the second fastest growing county in North Carolina.<sup>2</sup> From the 1960's to the present, the county (as well as the Oak Island towns) has witnessed steady increases in the number of newcomers, including a significant proportion of retirement population. Each town within the study area has continued to increase its population over the years, while still remaining as a low density beach community. Population and housing trends & projections are shown in Table 1.

The land use plans of each Oak Island town reflect the desire of each area to maintain low density development. Despite this, the study area population will double during the planning period.

#### **Economy and Employment**

An important factor to be considered in estimating the future traffic growth of an area is its economic base. The economic base determines the employment type and size, as well as commuter traffic patterns around the county. This in turn influences the population of an area. Business and tourism have enhanced the employment and economic opportunities in the area. Some of the businesses in the area are the Brunswick County Airport, a radio station, and Nations Bank. A large nuclear plant (owned by CP & L) exists north of the planning boundary, but its discharge canal streams into the boundary and ends within the Caswell Beach town limits. Residential communities make up most of Oak Island.

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<sup>2</sup> Statistics were compiled by the Office of State Budget and Management.



TABLE 1  
POPULATION TRENDS AND PROJECTIONS  
Oak Island Planning Boundary and Surrounding Areas

Year	Brunswick County	Lockwoods Folly Twp	Smithville Township	Long Beach	Caswell Beach	Yaupon Beach	Planning Boundary (Created 1995)
1960	20,278	4,289	3,355	102	*****	89	*****
1970	24,223	4,748	4,346	493	28	334	*****
1980	35,777	7,361	6,838	1,844	110	569	*****
1990	50,985	10,705	9,488	3,816	175	734	*****
1995	58,269	12,112	10,735	4,684	209	873	7,000
1998	67,441	*****	*****	*****	*****	*****	7,538
2000	71,190	*****	*****	*****	269	918	7,920
2010	87,331	*****	*****	*****	*****	*****	10,138
2025	106,001	*****	*****	*****	*****	*****	14,683

**More population information:**

- The 1960-1990 Brunswick County and township values were obtained from the Bureau of Census, US Department of Commerce.
- The 1995 township and the 2025 Brunswick County projections were found using the future population equation,  $F = P(1 + I)^n$ .
- The 1995-2020 Brunswick County values were obtained from the North Carolina Populations Projections, NC Office of State Planning, Summer 1992.
- The 1970-1990 town populations were obtained from the Bureau of Census, US Department of Commerce. The 1995 town populations and any projections were obtained from the land use plans for the towns and discussions with the town agencies. The Long Beach, Caswell Beach, and Yaupon Beach future populations could not be projected due to variability in city populations, annexations, and limits.

The 1990 Census reports 2,051 employed persons on Oak Island. Current estimates place 1997 employment at 2,700. Approximately 9.9% of the labor force is in manufacturing, which is higher than expected for resort communities. This level of manufacturing employment reinforces the idea that Oak Island serves as a significant "bedroom community" for employers in the region.<sup>3</sup>

## Land Use

Land use refers to physical patterns of activities and functions within an area. Figure 4 shows the planning area's existing land use. Nearly all traffic problems are relative to the land use in a specific area. For example, people are more attracted to the beach during the warmer months than they are in the winter. This can dictate when certain businesses are open during the year (and homes are rented out), and consequently, dictate when congestion will occur during the

<sup>3</sup> Information from 1997 Second Oak Island Bridge Corridor Land Use and Development Plan, William R. Farris, Public Planning and Management, September 10, 1997.



year. However, during the remainder of the year, few, if any, problems may occur. The spatial distribution of different land use types (sometimes referred to as traffic generators) is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

Typically in transportation planning, land uses are grouped into four categories:

- (1) Residential---all land devoted to the housing of people excluding hotels and motels;
- (2) Commercial---all land devoted to retail trade including consumer & business services and offices;
- (3) Industrial---all land devoted to manufacturing, storage, warehousing, and transportation of products;
- (4) Public---all land devoted to social, religious, educational, cultural, recreational, and political activities.

Determining where expected growth is to occur within the planning area makes the choice of proposed thoroughfare locations easier. Areas of anticipated development and growth for Oak Island are<sup>4</sup>:

Residential---The 34 building permits issued in Caswell Beach (1980-1990) reflects the town's desire for low density growth. Yaupon Beach appears to have adequate housing to support the town's desire for low density growth. Because of the lot sizes in Long Beach, the predominant single-family development will continue to be dense. However, the absence of central sewer service in Long Beach will hinder future residential construction.

Commercial/Retail---According to the Caswell Beach citizens' attitude survey, no major commercial development is expected to occur in Caswell Beach from the years 1990-2000. No new land use changes are anticipated during the study period. No major commercial development is expected to occur in Yaupon Beach from the years 1990-2000 as well. According to their land use survey, 108 wanted to encourage commercial growth and 108 wanted to discourage it (286 total surveys). Additional commercial development is expected to occur only in existing commercially-zoned areas, and that growth is expected to help increase the local population and tourist trade. Major changes in commercial land use are not expected from the years 1990-2003 in Long Beach.

Industrial---According to the Caswell Beach citizens' attitude survey, no major industrial development is expected to occur in Caswell Beach from the years 1990-2000. No new land use changes are anticipated during this time. The zoning ordinance in Yaupon Beach does not allow for any industrial land use.

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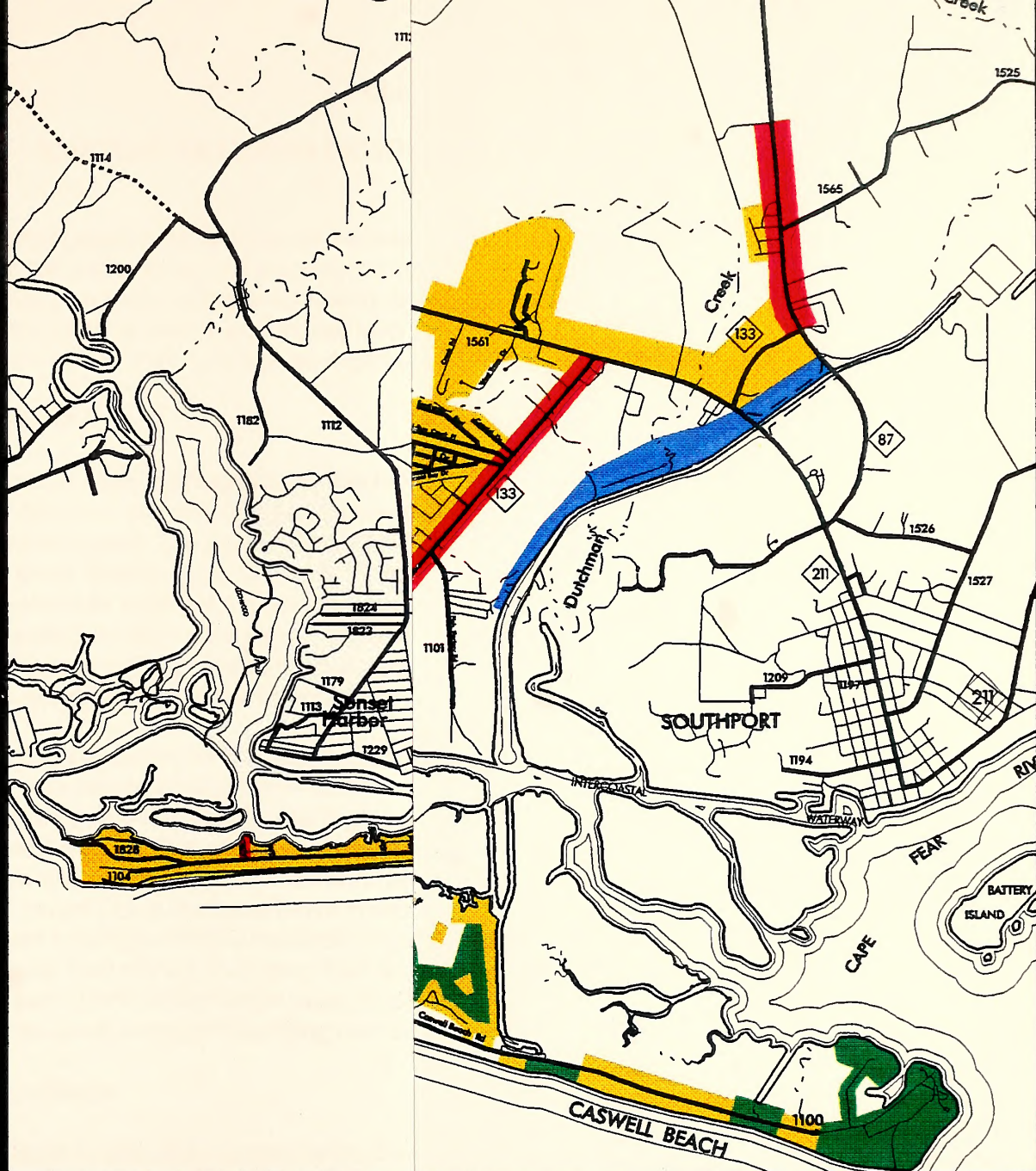
<sup>4</sup> Information from 1990 Land Use Plans of Caswell Beach and Yaupon Beach and the 1993 Land Use Plan of Long Beach. These plans were prepared by T. Dale Holland Consulting Planners.

No industrial zoning is expected to be established in Long Beach.

Public---No significant public development is expected in Caswell Beach or Yaupon Beach. However, Long Beach will continue to develop shoreline access sites, and (if available funding) pursue improvement/replacement of Fire Station Two. No other public land use changes are anticipated in Long Beach.

The western and northern portions of the planning area have the largest growth expectations. They are served by NC 133/211, Sunset Harbor Road (which runs west of the western boundary), and the proposed Second Oak Island Bridge.





### LEGEND

- RESIDENTIAL
- COMMERCIAL
- PUBLIC/SEMI-PUBLIC
- INDUSTRIAL

## FIGURE 4

# **GENERAL EXISTING LAND USE PLAN**

## **OAK ISLAND**

### **BRUNSWICK COUNTY NORTH CAROLINA**

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U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

Base Map Date: February 3, 1997

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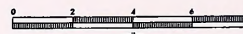


#### LEGEND

- RESIDENTIAL
- COMMERCIAL
- PUBLIC/SEMI-PUBLIC
- INDUSTRIAL

NOTE: This map is based on land use plans for  
Long Beach (1993), Yaupon Beach (1990),  
Caswell Beach (1990), and Brunswick County (1997).

October 28, 1997



#### FIGURE 4 GENERAL EXISTING LAND USE PLAN OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

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## Chapter 3

### EXISTING TRANSPORTATION SYSTEM AND DEFICIENCIES

This chapter presents an analysis of the existing street system. Emphasis is placed on detecting the deficiencies and understanding their cause. Travel deficiencies may be inadequate pavement width or intersection controls. System and capacity deficiencies could occur such as need for a bypass, loop facility, construction or missing links, or additional radials. Fold-out figures depicted here are located at the end of the chapter.

#### Travel Demand

Existing major street systems satisfy the travel demand when characteristics of each thoroughfare (i.e., number of lanes, lane and/or road width) allow traffic to move freely at a desirable speed. The travel demand is generally reported in the form of Annual Average Daily Traffic (AADT) counts. Traffic counts are taken regularly on State-maintained roads within the planning area by the NCDOT.

These counts were then compared to the capacity of the roads. Capacity is defined as the maximum amount of traffic to be accommodated by a given facility. (The Capacity Analysis section of this chapter gives more information.)

A comparison of annual traffic counts from 1985 to 1996 at various locations within the planning area shows average growth rates ranging from 0% to 7.9%. The largest growth was noticed on Midway Road. The higher growth rates result from the attractiveness of the area and the completion of Interstate 40. The growth is also dependent upon land use served within the planning area and the effect these land uses have on the traffic (i.e., Oak Island Drive/Yaupon Drive existing in a business district compared to Caswell Beach Road existing within a residential/government/industrial area (Caswell Beach Villas/Town Hall/CP&L Pumping Station)). Figure 7 shows the AADT volumes from the base year (1995) to the future year (2025). The AADT volumes does not show the full extent of seasonal travel; the existing and expected seasonal travel is shown in Figure 8.

#### Traffic Accidents

A traffic crash is also done as part of the thoroughfare planning process. Traffic crashes originate from three sources:

- (1) physical environment,
- (2) driver, and
- (3) physical attributes of the vehicle itself.

The physical environment includes such things as road condition, weather, road obstructions, and traffic conditions. The driver influences the occurrence of traffic accidents through his mental alertness, distractions in the car, the ability to handle the vehicle, and reaction time. The physical attributes of the vehicle include the condition of the brakes and tires, vehicle responsiveness, size of the vehicle, and how well the



windshield wipers and defrosters work. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.

Accident data for March 1992 through October 1997 was studied. Figure 9 shows locations with ten or more accidents during the period. Tables 2, 3, and 4 summarize the accidents occurring during this time period within the planning boundary. No accidents were reported in Caswell Beach between March of 1992 and October of 1997.

**Table 2: Long Beach Accident Summary (3/92 through 10/97)**

Type of Accidents	Number of Accidents
Ran-off-Road	15
Sideswipe	3
Angle	17
Rear-End	39 (includes 6 Rear-end Turns)
Other	13 (Bicycle (2), Backing (5), Other Object (6), Pedestrian, Overturn)
Left-Turn-Different-Roadway	7
Left-Turn-Same-Road	13
Right-Turn-Different-Roadway	4
Right-Turn-Same-Road	1

Beach Drive: 20 accidents

Oak Island Drive: 86 accidents

Middleton Drive: 3

Intersection with most accidents (11): Beach Dr/58<sup>th</sup> St/Oak Island Dr

Total number of accidents in Long Beach: 112

**Table 3: Yaupon Beach Accident Summary (3/92 through 10/97)**

Type of Accidents	Number of Accidents
Ran-off-Road	1
Sideswipe	2
Angle	14
Rear-End	13
Other	2 (Backing)
Left-Turn-Different-Roadway	4
Left-Turn-Same-Road	10
Right-Turn-Different-Roadway	1
Right-Turn-Same-Road	1

Country Club Road: 20 accidents

Yaupon Drive: 21 accidents

Intersection with most accidents (15): Country Club Road/Yaupon Drive

Total number of accidents in Yaupon Beach: 48



**Table 4: Accidents outside City Limits but within Planning Boundary**  
**Accident Summary (3/92 through 10/97)**  
 Accidents at NC 133/NC 211 intersection

Type of Accidents	Number of Accidents
Ran-off-Road	4
Sideswipe	1
Angle	7
Rear-End	25
Other	5 (Overturn, Animal, Backing(2), Bicycle)
Left-Turn-Different-Roadway	11
Left-Turn-Same-Road	19
Right-Turn-Different-Roadway	14
Right-Turn-Same-Road	1

NC 133: 107 accidents

NC 211: 55 accidents

Intersection with most accidents (77): NC 133/NC 211

Total no. of accidents outside City Limits & within Planning Boundary:165

## Capacity Analysis

An adequate street system is determined by comparing the traffic volumes with the traffic mobility of the streets. The ability of traffic to move on a street freely, safely, and efficiently with a minimum delay is controlled by sign spacing or traffic signals used.

Capacity represents the maximum amount of traffic to be accommodated by a given facility under prevailing roadway and traffic conditions. The traffic volume relationship to the roadway capacity will determine the *level of service* being provided. Six levels of service identify the range of possible conditions.

The six levels of service are illustrated in Figure 6, and are defined in Table 5. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. The 1994 Highway Capacity Manual contains detailed descriptions of the levels of service as defined for each facility type.

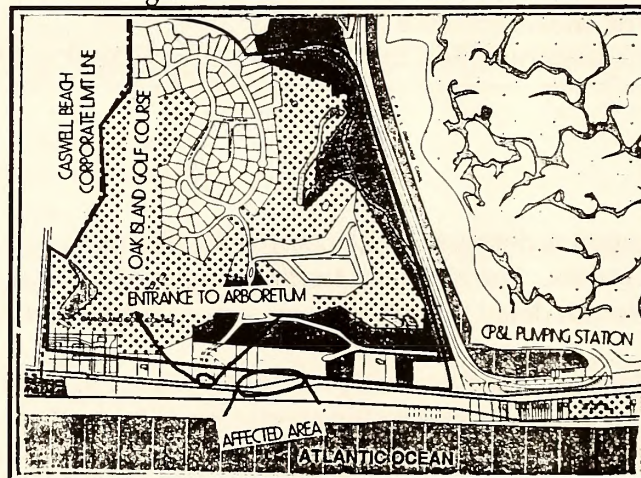
The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing and new facilities. LOS D is considered the "practical capacity" of a facility, or that at which the public begins to express dissatisfaction.

The primary routes serving Oak Island are NC 133 and NC 211. NC 133 enters from the north and becomes a three-lane road ending in Yaupon Beach. NC 211 travels east-west on the mainland and ends at the Ferry terminal on Southport. The towns are also served by Caswell Beach Road, Beach Road, Oak Island Drive, and Yaupon Drive.

Capacity deficiencies during the 25-year planning period occur in two locations. The first is along NC 133/211 between Doshier Cutoff Road (at the northeastern planning boundary) and NC 133. The second is along NC 133 from the NC 211 intersection to Yaupon Drive. The congestion worsens during summer holidays and weekends with visiting tourists. Yaupon Drive and Oak Island Drive (commercial strips) becomes congested due to the increased number of drivers.

Pedestrians, bicycles, and autos use Caswell Beach Road and Beach Drive during the summer months. Neither of these routes will experience capacity problems during the planning period. Keeping Beach Drive free of water and debris requires yearly maintenance. Beach erosion has required one relocation of Caswell Beach Road. The ocean eroded the original road bed, located within one half-mile of the Arboretum entrance. The spring of 1996 brought hurricane Bertha and new sand to the eroded area, though erosion continues to be a threat. Figure 5 shows the location of the eroded area.

Figure 5: Caswell Beach Eroded Area

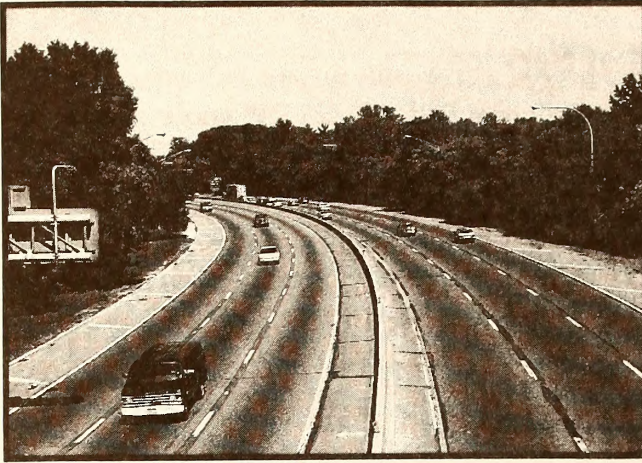




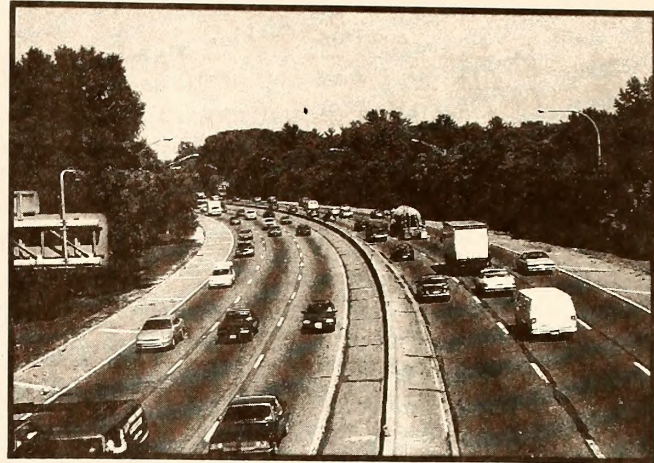
**Table 5: Level of Service**

<b>LOS A</b>	Describes primarily free flow conditions. The motorist experiences a high level of physical and psychological comfort. The effects of minor incidents of breakdown are easily absorbed. Even at the maximum density, the average spacing between vehicles is about 528 ft, or 26 car lengths.
<b>LOS B</b>	Represents reasonably free flow conditions. The ability to maneuver within the traffic stream is only slightly restricted. The lowest average spacing between vehicles is about 330 ft, or 18 car lengths.
<b>LOS C</b>	Provides for stable operations, but flows approach the range in which small increases will cause substantial deterioration in service. Freedom to maneuver is noticeably restricted. Minor incidents may still be absorbed, but the local decline in service will be great. Queues may be expected to form behind any significant blockage. Minimum average spacings are in the range of 220 ft, or 11 car lengths.
<b>LOS D</b>	Borders on unstable flow. Density begins to deteriorate somewhat more quickly with increasing flow. Small increases in flow can cause substantial deterioration in service. Freedom to maneuver is severely limited, and the driver experiences drastically reduced comfort levels. Minor incidents can be expected to create substantial queuing. At the limit, vehicles are spaced at about 165 ft, or nine car lengths.
<b>LOS E</b>	Operations in this level are volatile with little or no usable gaps in the traffic stream. Any disruption to the traffic stream can cause a wave of delay that propagates throughout the upstream traffic flow. This can produce a serious breakdown with extensive queuing. Maneuverability within the traffic stream is extremely limited, and driver tensions are high. The high delay values created by LOS F at signalized intersections indicate poor progression, long cycle lengths, and high v/c ratios (ratio of the demand flow rate to capacity for a traffic facility).
<b>LOS F</b>	Describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points.

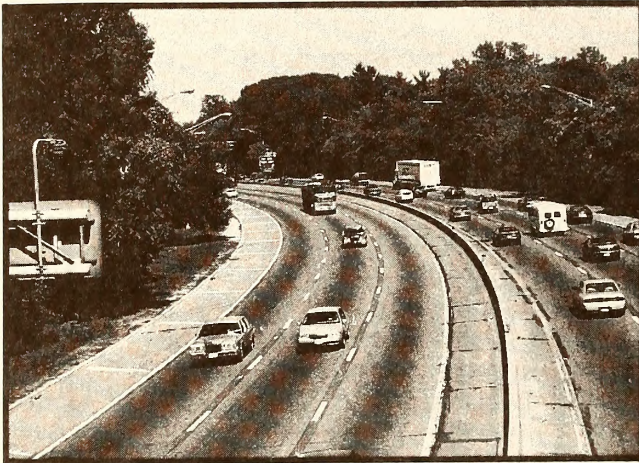




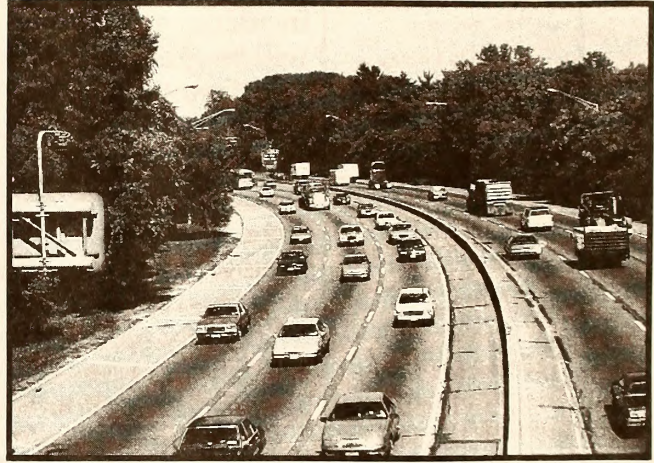
*LOS A.*



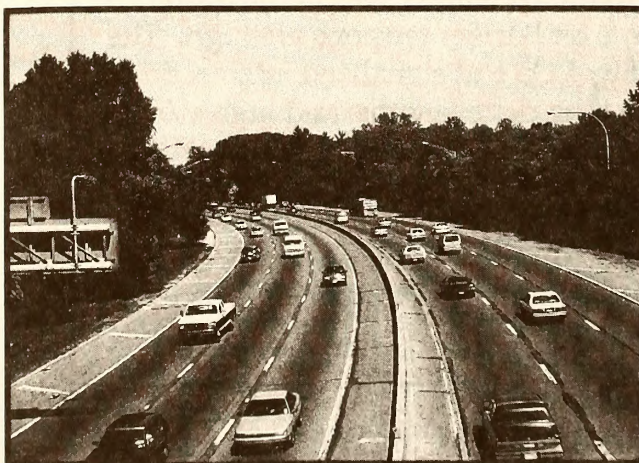
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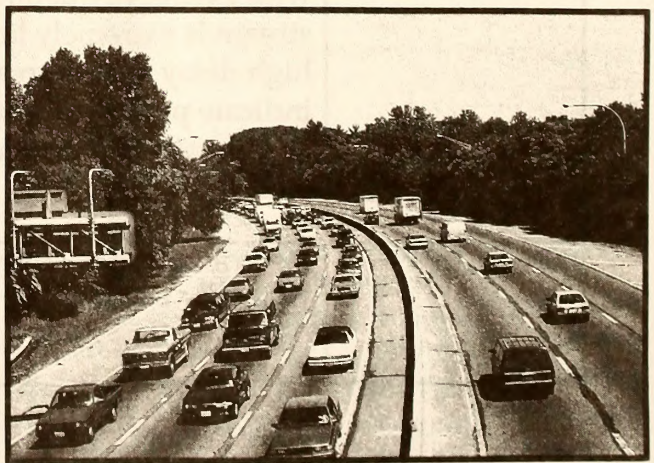
*LOS B.*



*LOS E.*



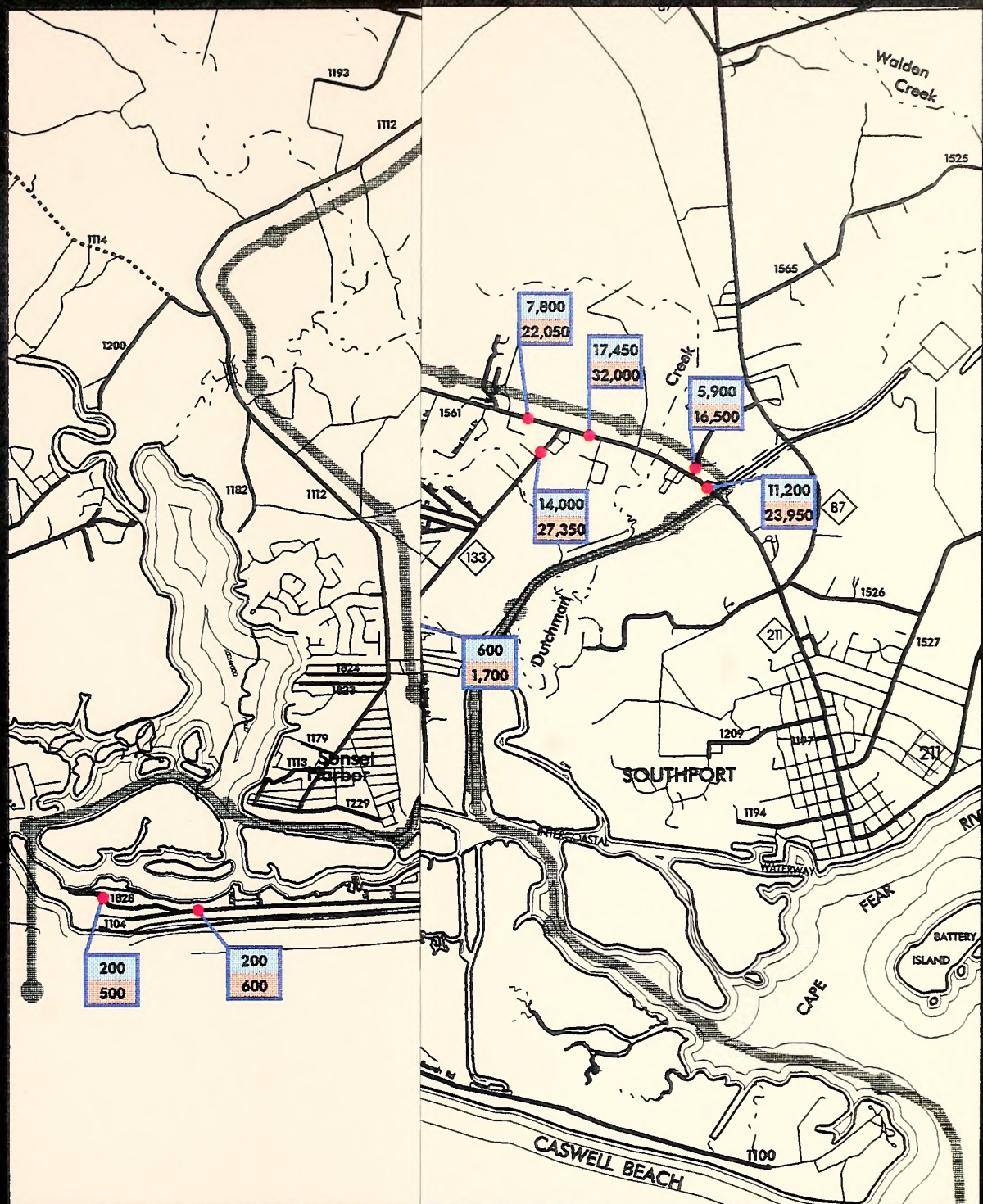
*LOS C.*



*LOS F.*

**FIGURE 6**  
**LEVELS OF SERVICE**





### LEGEND

PLANNING AREA BOUNDARY

1995 AVERAGE DAILY TRAFFIC VOLUME

2025 AVERAGE DAILY TRAFFIC VOLUME

## FIGURE 7 ANNUAL AVERAGE DAILY TRAFFIC VOLUMES

*excluding Thoroughfare Plan Projects*

### OAK ISLAND

BRUNSWICK COUNTY  
NORTH CAROLINA

PREPARED BY THE

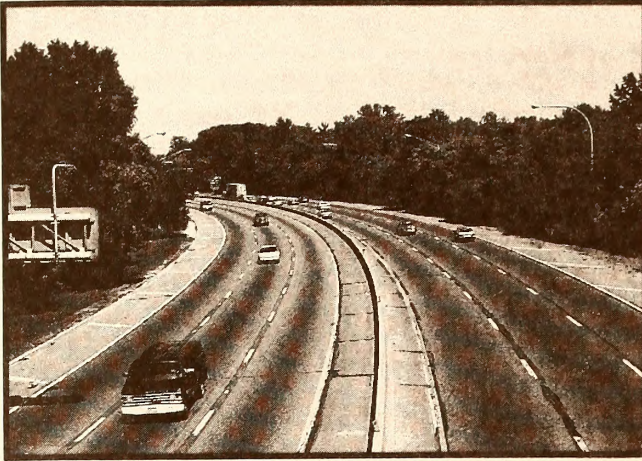
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STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

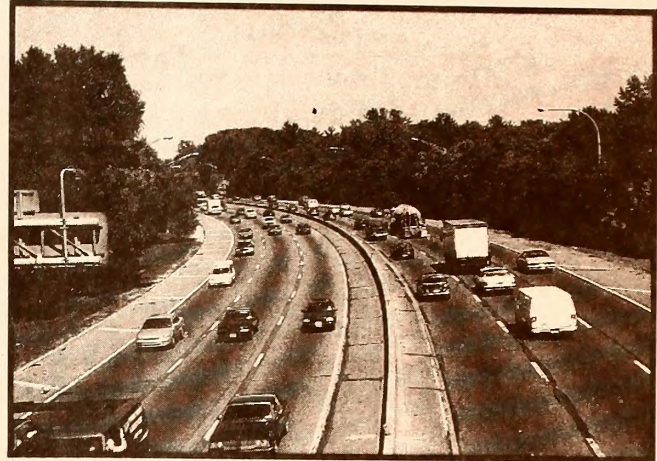
U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

Base Map Date: February 3, 1997

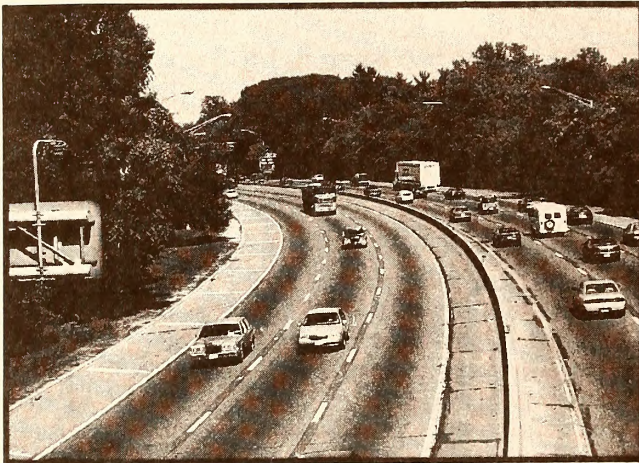




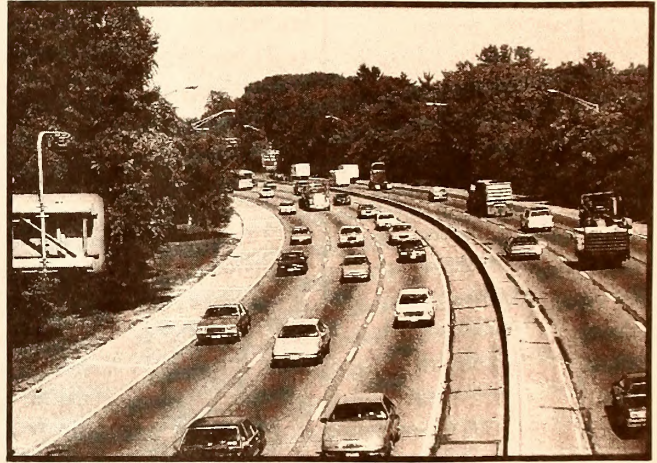
*LOS A.*



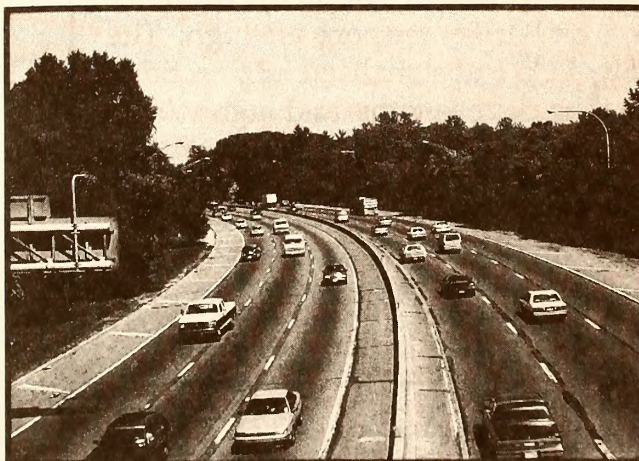
*LOS D.*



*LOS B.*



*LOS E.*



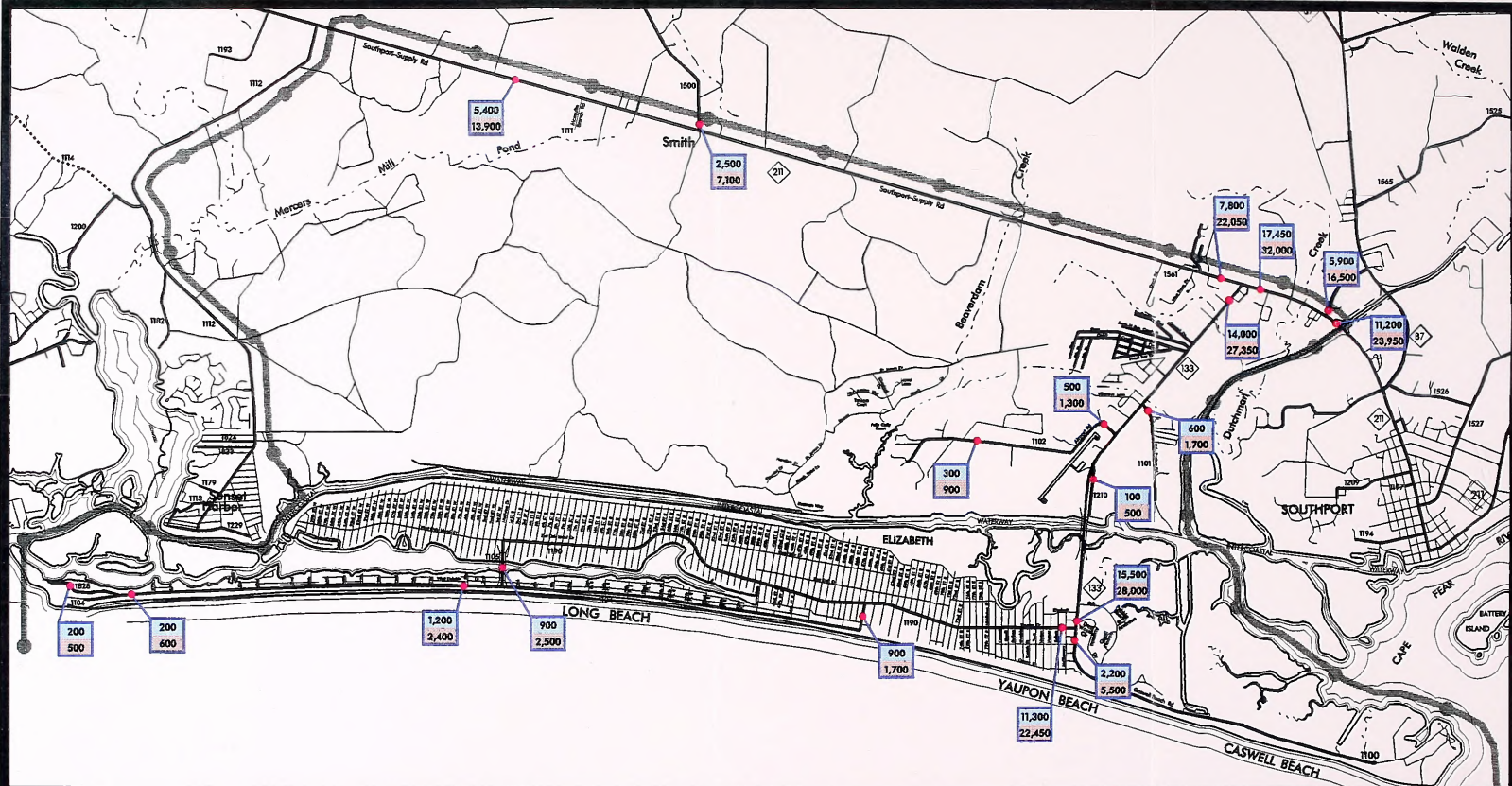
*LOS C.*



*LOS F.*

**FIGURE 6**  
**LEVELS OF SERVICE**





### LEGEND

PLANNING AREA BOUNDARY

1995 AVERAGE DAILY TRAFFIC COUNT 00000

2025 AVERAGE DAILY TRAFFIC COUNT 00000

October 28, 1997



### FIGURE 7 ANNUAL AVERAGE DAILY TRAFFIC VOLUMES excluding Thoroughfare Plan Projects OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

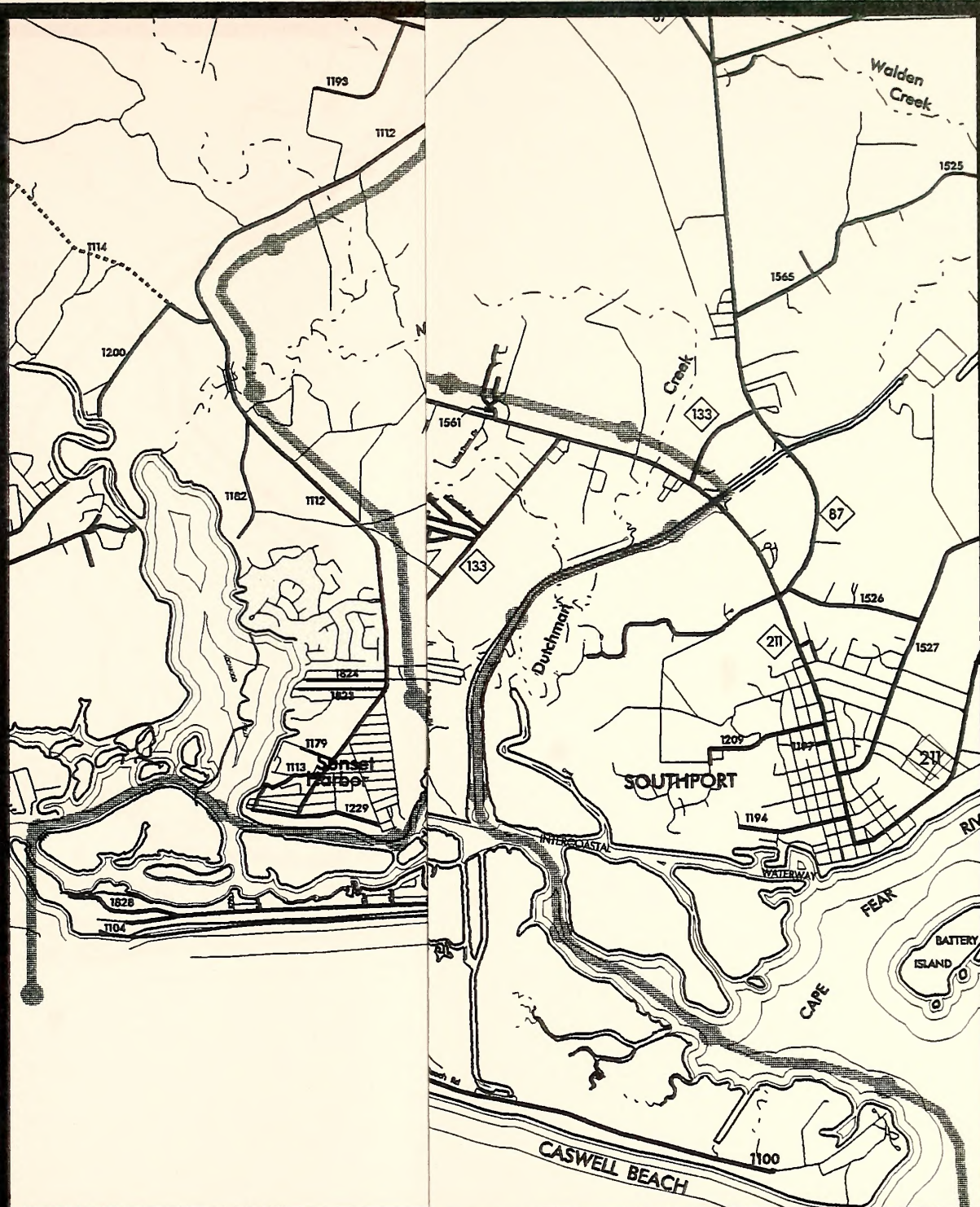
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FEDERAL HIGHWAY ADMINISTRATION

Base Map Date: February 3, 1997







### LEGEND

PLANNING AREA BOUNDARY

AUG. 1996 PEAK SUMMER TRAFFIC  
2025 PEAK SUMMER TRAFFIC CO

## FIGURE 8 **PEAK SUMMER TRAFFIC COUNTS** *excluding Thoroughfare Plan Projects* **OAK ISLAND** **BRUNSWICK COUNTY** **NORTH CAROLINA**

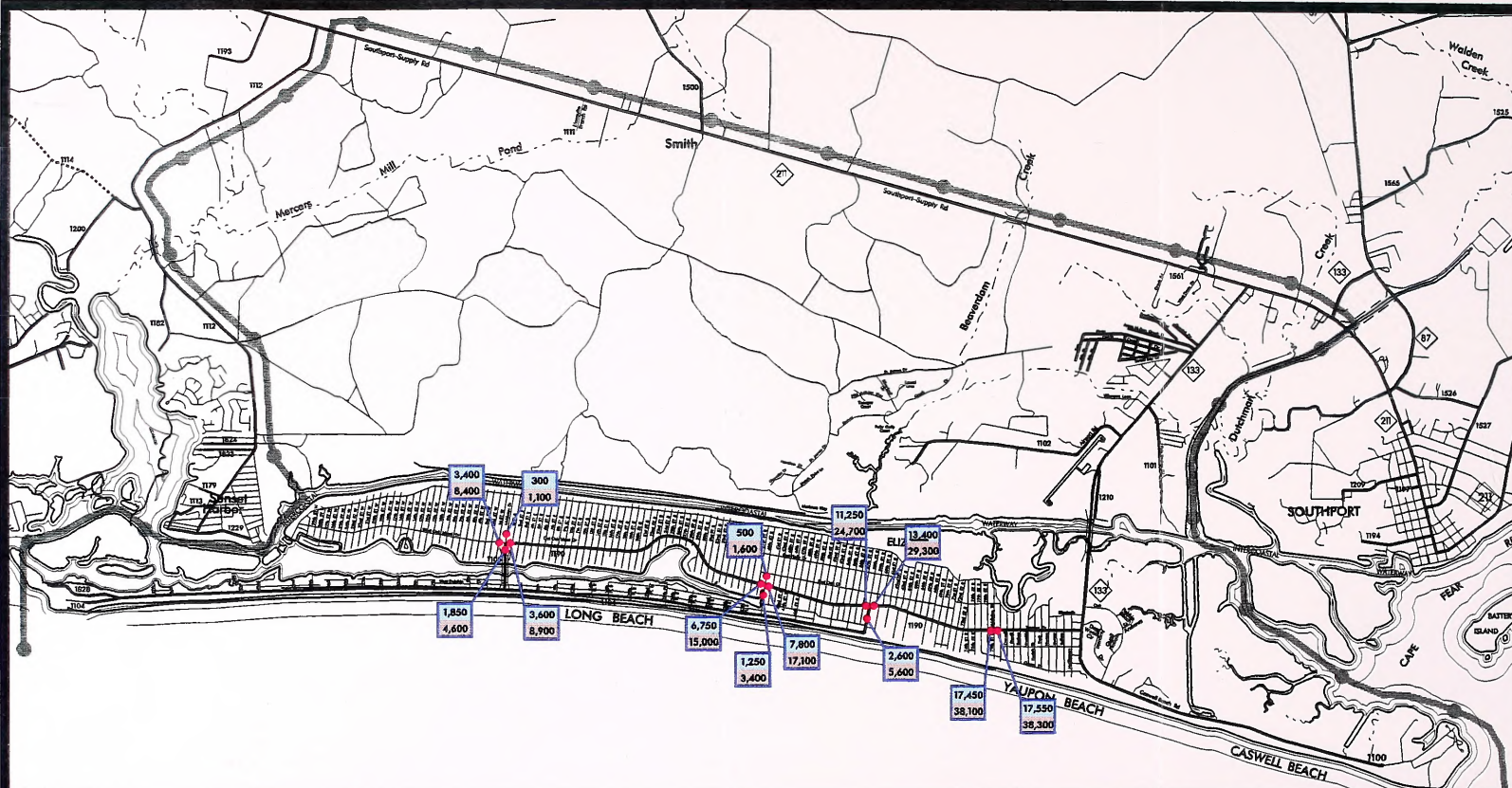
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STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE  
U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

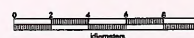
Base Map Date: February 3, 1997







October 28, 1997



**FIGURE 8**  
**PEAK SUMMER**  
**TRAFFIC COUNTS**  
*excluding Thoroughfare Plan Projects*

**OAK ISLAND**  
 BRUNSWICK COUNTY  
 NORTH CAROLINA

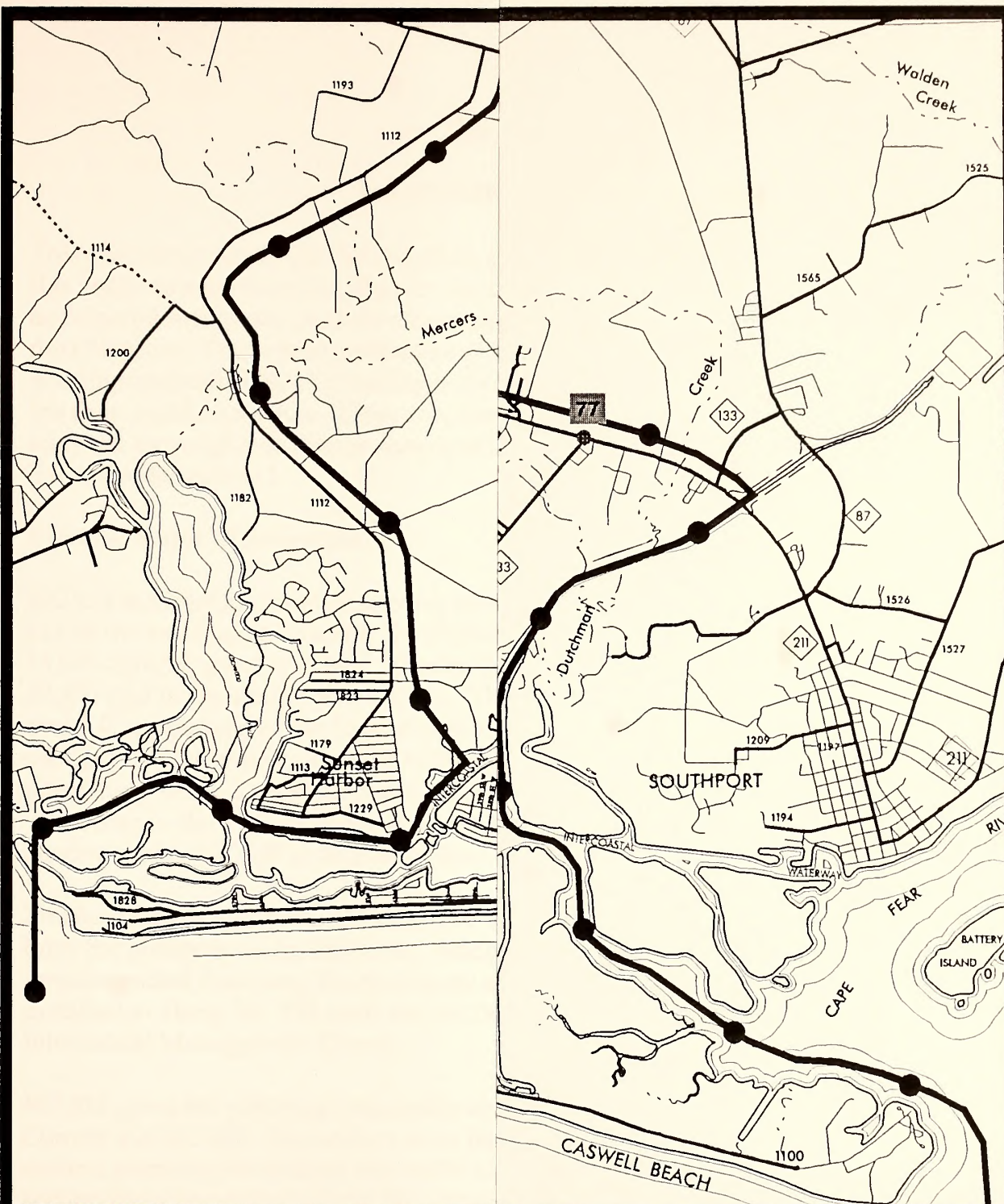
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IN COOPERATION WITH SAS  
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 FEDERAL HIGHWAY ADMINISTRATION

Base Map Date: February 3, 1997







### LEGEND

PLANNING AREA BOUNDARY ●

NUMBER OF ACCIDENTS DURING  
392 - 1097 TIME PERIOD

## FIGURE 9 LOCATIONS WITH 10+ ACCIDENTS OVER A 5.5 YEAR PERIOD OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

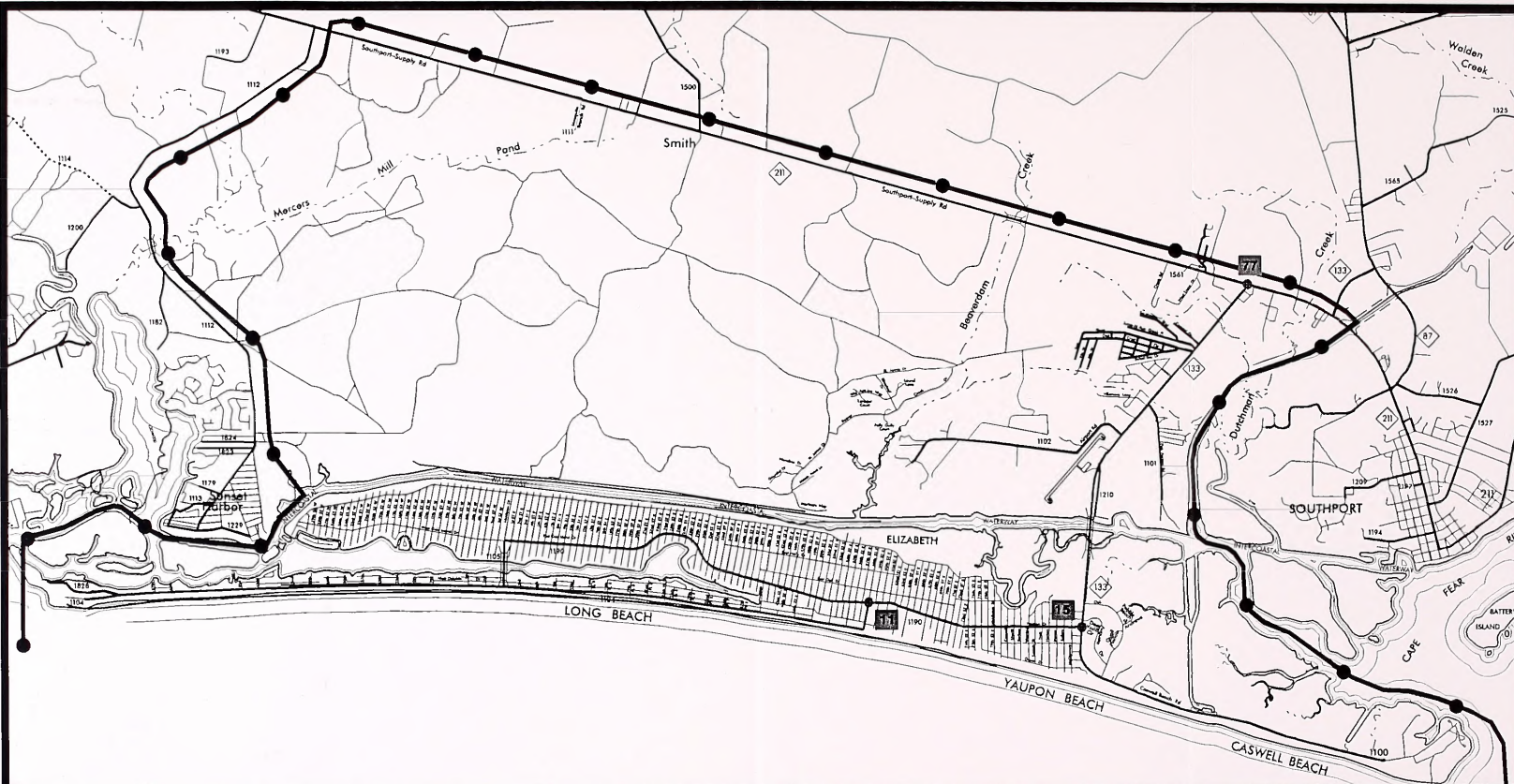
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FEDERAL HIGHWAY ADMINISTRATION

Base Map Date: February 3, 1997







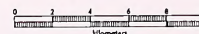
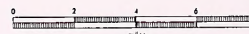
# LEGEND

PLANNING AREA BOUNDARY

NUMBER OF ACCIDENTS DURING  
392 - 1097 TIME PERIOD



October 28, 1997



## FIGURE 9 LOCATIONS WITH 10+ ACCIDENTS OVER A 5.5 YEAR PERIOD OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

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FEDERAL HIGHWAY ADMINISTRATION

Base Map Date: February 3, 1997





## Chapter 4

### RECOMMENDATIONS

This chapter presents the thoroughfare plan recommendations. It is the goal of this study to recommend a plan for the transportation system that will serve the anticipated traffic and land development needs of the Oak Island area over the next 30 years. The primary objective of this plan is to reduce traffic congestion and improve safety by eliminating both existing and anticipated deficiencies in the thoroughfare system. These recommendations are shown in Figure 1. The adopted thoroughfare plan is shown in Figure 2. (Both are located in the Executive Summary.)

#### Existing Major Thoroughfares

**NC 133** is the primary route serving the Oak Island area. The section from NC 211 to the existing bridge over the Intercoastal Waterway carries approximately 14,000 vehicles per day (vpd). This traffic volume is projected to increase to 27,350 vpd in the design year (2025). (The capacity of this road section is 15,500 vpd.) Construction of the Second Oak Island Bridge will reduce this traffic in the design year. However, the road will again reach capacity toward the end of the planning period. Development (a grocery store, new neighborhood, etc.) will also occur in the vicinity of the airport. Therefore, it is recommended as a future need to widen NC 133 to five lanes from NC 211 to Old Bridge Road.

Traffic volumes along NC 133 from NC 211 to the existing Oak Island Bridge limit the ability to make left turns. Additional signals may improve this. It is recommended that Long Beach request a study on driveway access and signal installation along NC 133 from the NCDOT Municipal Assistance and Intermodal Management Group.

**NC 211** gives the planning area traffic access to the remainder of Brunswick County via NC 133. The section from Bayview Drive to the CP&L Bridge (the eastern planning boundary) has traffic either approaching or over capacity. The section from Bayview Drive to NC 133 carries 7,800 vpd and is projected to carry 22,050 vpd by the design year. (Capacity: 23,200 vpd.) The remainder of NC 211 to the CP&L bridge carries 17,450 vpd, and is projected to carry 32,000 vpd in 2025. (Capacity: 12,667 vpd.) Due to the traffic anticipated from the new bridge, it is recommended that NC 211 from SR 1500 (Midway Rd) to the CP&L bridge be widened to a four-lane section with a grass median.

**Yaupon Drive/Oak Island Drive (SR 1190)** begins at NC 133 in Yaupon Beach as Yaupon Drive. The route continues west into Long Beach (name changes to Oak



Island Drive) and state maintenance ends at Middleton Road. Oak Island Drive continues as a town street to end at Yacht Drive. This section of Oak Island Drive has been designated as a minor thoroughfare for this study. The road serves commercial & residential properties, a school, and churches.

The three-lane section from NC 133/Caswell Beach Road to 0.6 mi west of Beach Road approaches capacity. This section carries 11,300 vpd and is projected to carry 22,450 vpd in the design year. (Capacity: 13,800 vpd.) The Second Oak Island Bridge will help decrease congestion along this route by opening a second access to the Island. If the second bridge is not built, additional capacity would be required, either by widening or by adding reversible lanes for the peak periods. It is recommended to keep the Yaupon Drive/Oak Island Drive section from NC 133/Caswell Beach Road to 29<sup>th</sup> Street as is.

A driveway access study (completed by the NC DOT Municipal Assistance and Intermodal Management Group) recommends improvements and traffic channelization for the section from 46<sup>th</sup> Street to 64<sup>th</sup> Street. Access improvements may include restricting the location and size of each driveways. These improvements can eliminate unwanted traffic movements and reduce the number of decision points for drivers. Traffic channelization involves the use of islands and/or curbing at driveways and intersections to provide guidance and simplify the decision process of motorists. These improvements will help decrease congestion along this section.

The section from 29<sup>th</sup> Street to Middleton Road carried 3,600 vpd for the month of August 1996, and was projected to carry 8,900 vpd for the same month during 2025. This Oak Island Drive section should be widened to 3 lanes to support the anticipated traffic.

### **Proposed Major Thoroughfares**

The biggest traffic deficiency of this area is ingress onto and egress from the island. Currently, there is only one way to enter and leave the island. First mention of a second bridge to the mainland came on February 15, 1967. The suggested site was the Yellow Banks (today's Middleton Street area). It became a subject at a public hearing in which NC DOT officials conceded "there is an apparent need for this additional access to the growing resort area. It would require a highway extending from the end of Lincolnton Street to ... Midway."<sup>5</sup> The NC TIP includes a second bridge project to Oak Island, from Beach Drive to NC 211 (R-2245). Middleton Avenue from Beach Drive to Oak Island Drive will

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<sup>5</sup> The information for the history of Oak Island came from "The history of Oak Island", *The State Port Pilot*, Spring 1995. Other data from this composition has been used throughout this report.



be widened (calling for the replacement of Bridge # 206 over Davis Creek), and a 2-lane facility from Middleton to NC 211 will be constructed on a new location. This construction should improve traffic deficiencies in Yaupon Beach within the area of the NC 133/Country Club Road/Yaupon Drive intersection. Evacuation of the island will become easier with this construction.<sup>6</sup>

The NC 87 to NC 133 Connector (TIP R-3324) will help relieve congestion on NC 211 in the vicinity of NC 133 and NC 87. Planning is scheduled in the year 2000 and construction post 2200. It is recommended that the NC 87 to NC 133 connector be four lanes.

### **Existing Minor Thoroughfares**

**Beach Drive (SR 1104)** begins at Oak Island Drive in Long Beach and continues south. The route then takes a 90-degree turn to the west and continues west to end in an area named King's Lynn (the westernmost point of Long Beach). This route serves residences, a few businesses, and beach accesses.

The Beach Drive section from Oak Island Drive to the 90-degree turn carries 2,600 vehicles during the month of August 1996 and is projected to carry 5,600 vehicles during this same month in 2025. (The capacity is 13,000 vehicles per day.) No capacity problems exist along this route. (Refer to the Bicycle Recommendations Section of this chapter for more information.)

**Caswell Beach Rd (SR 1100)** is the main route for Caswell Beach. The route begins at NC 133/Yaupon Drive and continues south and then east to end at the Fort Caswell Baptist Assembly. This routes serves residences and the Assembly.

This route carries 2,200 vehicles per average weekday and is projected to carry 5,500 vehicles per average weekday in the design year. (The capacity is 11,000 vehicles per day.) No capacity problems exist along this route. (Refer to the Bicycle Recommendations Section of this chapter for more information.)

**Yacht Drive** is a two-lane, local street that is the most northern street in the town of Long Beach. The section from West Oak Island Drive to 58<sup>th</sup> Street carries local traffic throughout the town and routes traffic to Oak Island Drive. According to the town agencies and public, this is a route used by drivers when Oak Island Drive has become congested. No recommendations are made for this route.

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<sup>6</sup> "Peak Season Population Estimates for Brunswick County and Estimated Evacuation Time", March 15, 1983 letter from Larry Goode, Ph.D., PE to Gerald Fleming, Safety and Emergency Planning Department, and "Oak Island Evacuation Study Update", A.K. Lash, EIT, June 1998.



**Fifty-Eighth Street** is a two-lane, local street that connects Oak Island Drive with Yacht Drive. It, like Yacht Drive, carries local traffic and routes traffic to Oak Island Drive. No recommendations are made for this route.

There are a few two-lane, state-maintained facilities in the area that have lane widths less than 12 feet. These lanes should be widened to 12 feet for safe and adequate operation. These facilities, along with the other recommendations, are given in Appendix A.

There are no proposed Minor Thoroughfares in the planning area.

### **Recommendations For Bicycle Accommodations**

A beach area is an ideal place for tourists and permanent residents to bike around their neighborhood and surrounding areas. The Oak Island planning area is no different. However, if no bicycle routes are present, and no accommodations are made for bicycles along main routes through the town, no one will be able to enjoy the pleasures of biking.

NC Bike Route 3, or the Ports of Call Route, runs the South Carolina border, through Brunswick County and ends at the Virginia State Line near Corapeake. Within the planning area, Bike Route 3 follows NC 211. Any recommendations for local bicycle accommodations tie into NC Bike Route 3. Figure 10 shows the sections of Bike Route 3 within the county.

It is recommended that bicycle accommodations be built:

- 1) along both sides of Beach Drive from Middleton Road to its west end
- 2) along Caswell Beach Road from the Yaupon Beach City Limits to its east end (at the Baptist Assembly entrance)
- 3) along Yaupon Drive/East Oak Island Drive from NC 133 to Beach Road
- 4) along Caswell Beach Road from Yaupon Beach City Limits to NC 133
- 5) along NC 133 from NC 211 to the Intercoastal Waterway Bridge (IW Bridge) and from the south end of the IW Bridge to Caswell Beach Road/Yaupon Drive
- 6) along both TIP Projects R-2245 (Second Oak Island Bridge) and R-3324 (Doshier Cutoff Bypass)

Refer to Figure 11 for the recommendations for bicycle accommodations. Each of these recommendations will serve the bicyclist within the planning area and give the bicyclist access to the NC Bike Route 3.





## LEGEND

South Brunswick  
Islands Route D-1



Blockade Runners  
Route D-2



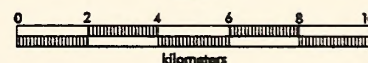
FIGURE 10

# *Bike Routes in Brunswick County*

## OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

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STATEWIDE PLANNING BRANCH  
IN COOPERATION WITH THE  
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### SCALES





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# LEGEND

South Brunswick  
Islands Route D-1



Blockade Runners  
Route D-2



FIGURE 10

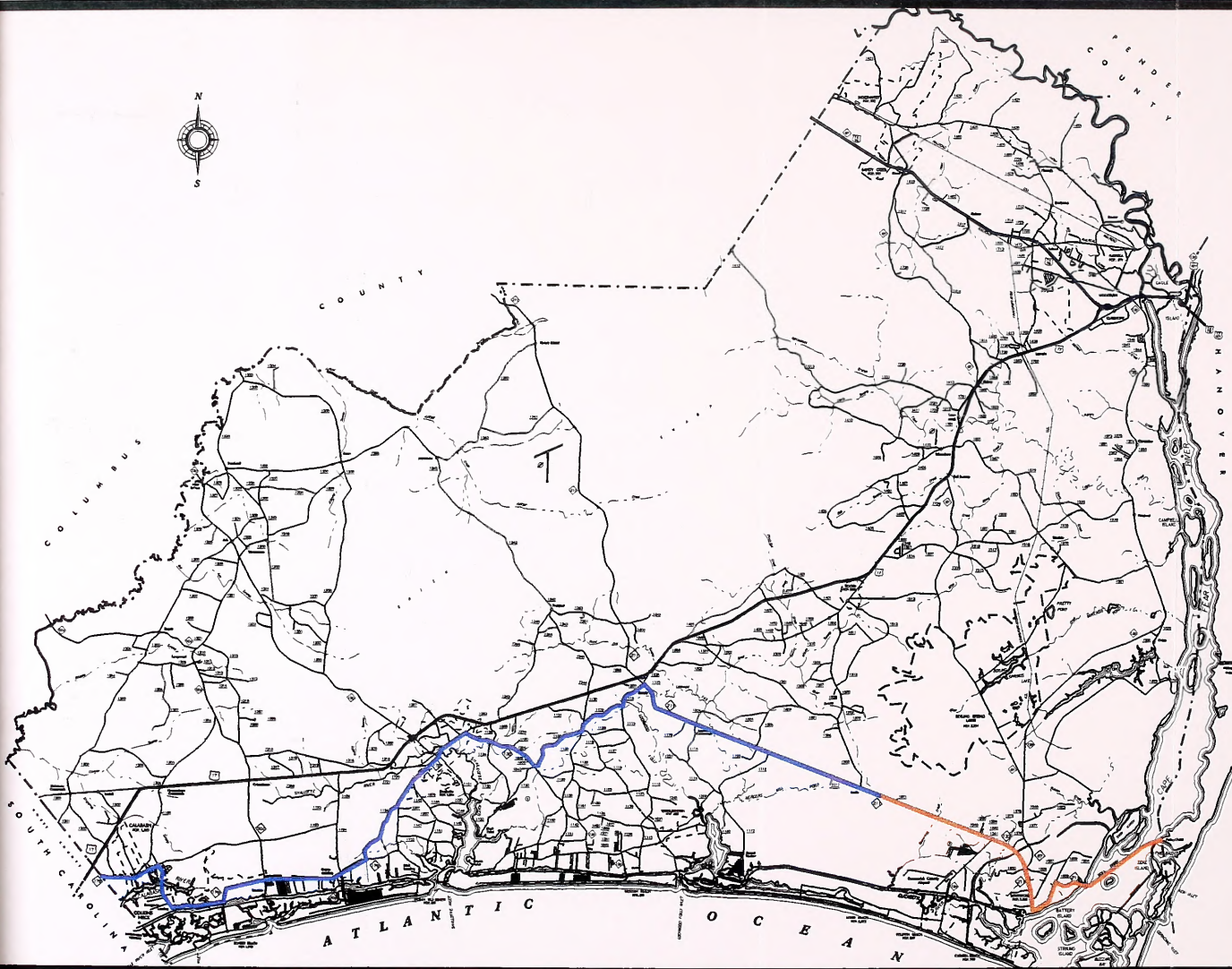
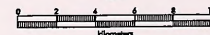
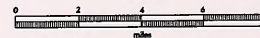
## *Bike Routes in Brunswick County*

### OAK ISLAND BRUNSWICK COUNTY NORTH CAROLINA

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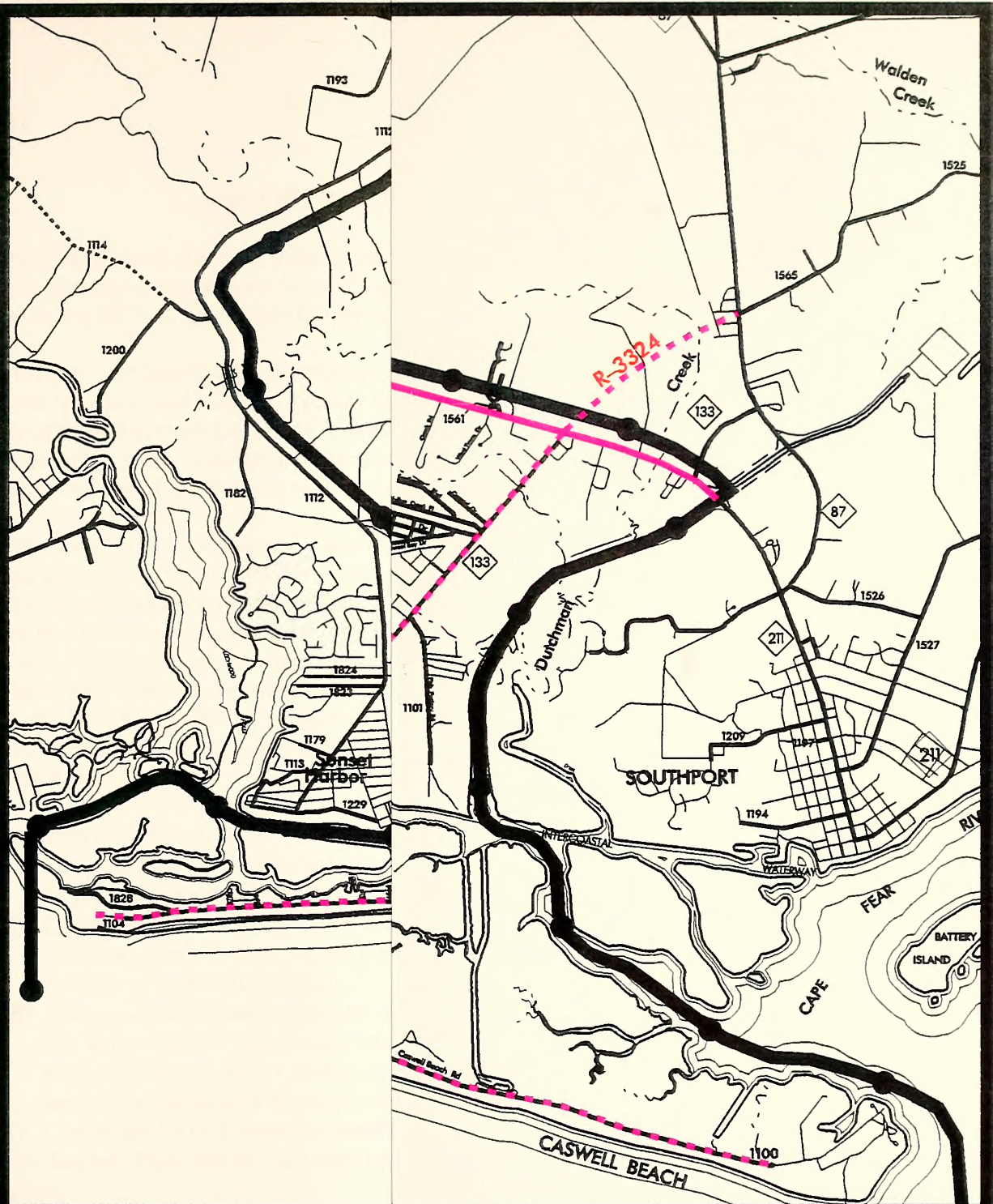
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SCALES









**LEGEND**

BICYCLE ACCOMODATIONS --- EXIST

PLANNING AREA BOUNDARY ●

**FIGURE 11**

**RECOMMENDATIONS**

**FOR**

**BICYCLE ACCOMODATIONS**

**OAK ISLAND**

**BRUNSWICK COUNTY**

**NORTH CAROLINA**

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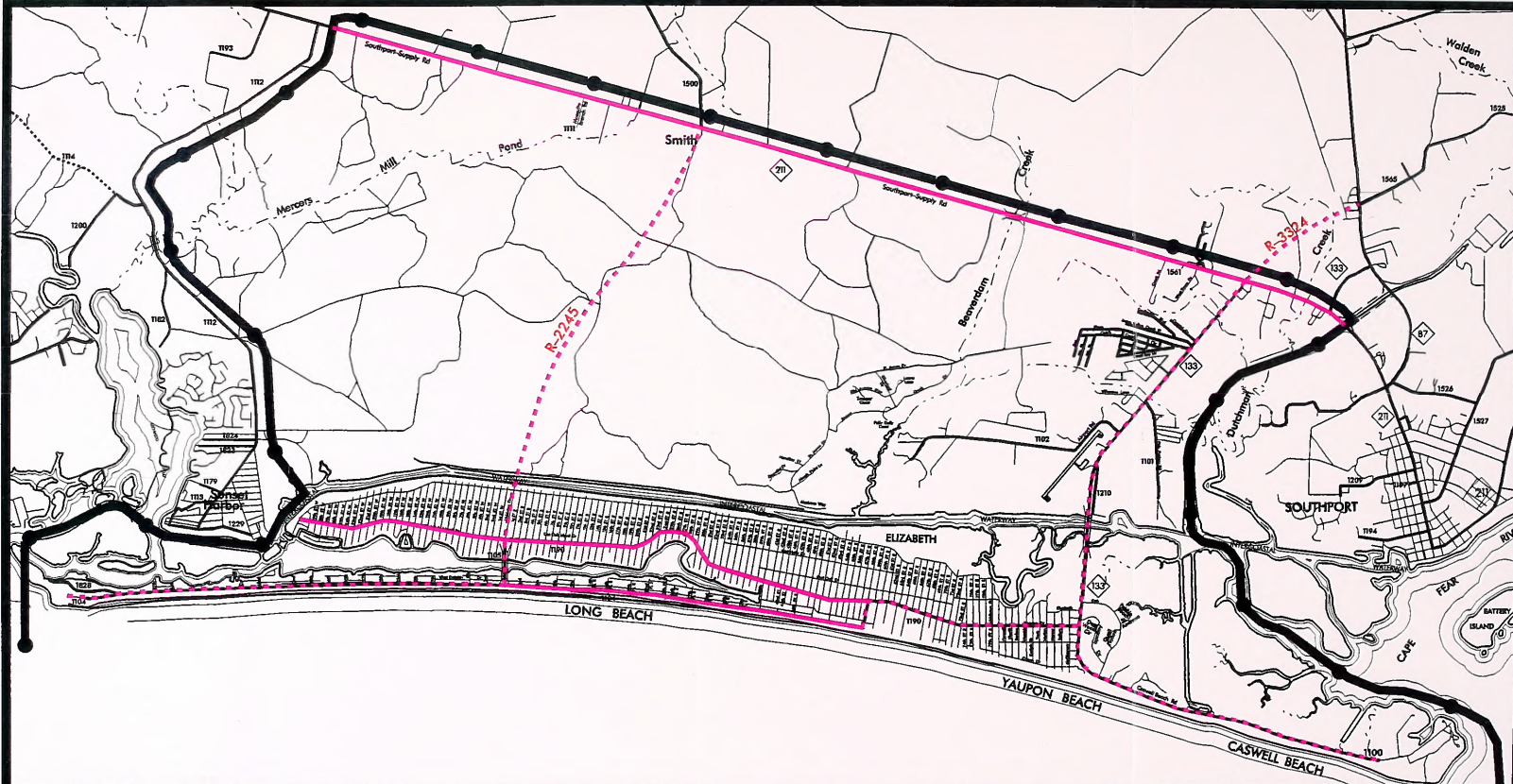
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**FEDERAL HIGHWAY ADMINISTRATION**

Base Map Date: February 3, 1997







**LEGEND**

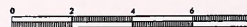
BICYCLE ACCOMODATIONS

EXISTING ———

PROPOSED - - - - -

PLANNING AREA BOUNDARY ———●———

October 28, 1997



**FIGURE 11**  
**RECOMMENDATIONS**  
**FOR**  
**BICYCLE ACCOMODATIONS**  
**OAK ISLAND**  
**BRUNSWICK COUNTY**  
**NORTH CAROLINA**

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## Chapter 5

### AIRPORT RECOMMENDATIONS<sup>4</sup>

The Brunswick County Airport, initially opened in 1964, serves the eastern areas of Brunswick County and southern New Hanover County. It is located adjacent to and is provided access by NC 133 within the city of Southport.

The airport has one 4000-ft x 75-ft runway. The apron provides 41 tiedown spaces. This is sufficient for the based aircraft, but not for itinerant aircraft. The terminal building is 2000 SF in size and houses a number of services: operations for the fixed base operator (FBO), classroom, pilots' lounge, offices restrooms, and central terminal area. The 3500 SF hangar is used by the FBO as a maintenance facility.

The Brunswick County Airport is expected to continue its growth. Total annual operations grew from 500 in 1996 to 33,500 in 1991. The number of operations per based aircraft increased from 100 in 1966 to 1,046 in 1991. The high 1991 average may be indicative of the itinerant operations which occur at the airport as a result of the coastal location and resort economy environment. Activity was generated by an active FBO, flight school, and maintenance facility. In 1992, the flight school and maintenance operation closed and the FBO management changed. Continued strong growth will be predicated upon the Airport Commission securing a new flight school and/or maintenance facility.

A 1992 master plan included the following major recommendations:

- 1) Lengthening and widening of runway to an 5000-ft x 100-ft area for the airport to operate under Basic Transport Airport standards.
- 2) Construction of a full parallel taxiway. Due to the expected annual and itinerant operations increase, construction of a full parallel taxiway for a 5000-ft runway is recommended.
- 3) Construction of both corporate and T-hangars with taxiways to help protect the aircraft in the potentially harsh coastal environment. Space is currently available for six 60-ft x 60-ft corporate hangars, two additional conventional service hangars, and three 10-unit T-hangars.
- 4) Construction of a seaplane landing base.

An Airport Layout Plan figure and other recommendations are included in the 1992 master plan.

Property acquisition, residential and commercial relocations, and relocation of a portion of Airport Rd will be necessary for the recommended improvements. Refer to the Master Plan for an illustration of the parcels to be acquired by the airport and a list of the affected parcels. The total acquisition and relocation costs are estimated at \$1.9 million.

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<sup>4</sup> The information for the Airport Recommendations Chapter came from the "Brunswick County Airport Master Plan Update", by T. Dale Holland Consulting Planners for the Brunswick County Airport Commission, August, 1992.

THE HISTORY OF THE UNITED STATES

The first volume of the series, published in 1893, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The second volume, published in 1894, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The third volume, published in 1895, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The fourth volume, published in 1896, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The fifth volume, published in 1897, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The sixth volume, published in 1898, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The seventh volume, published in 1899, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.

The eighth volume, published in 1900, was a landmark in the history of American literature. It was the first of a series of ten volumes, each of which was published in a separate volume.



## Chapter 6

### CONSTRUCTION IMPROVEMENTS AND COST ESTIMATES

The recommended improvements (refer to Figure 1) in this thoroughfare plan cannot be undertaken all at once, nor should they be. The need for projects is based on traffic projections for a thirty-year design period. Therefore, projects must be prioritized in order for realistic scheduling to be possible. In an effort to provide a common denominator to compare various improvement projects in the recommended Thoroughfare Plan, an assessment has been made of the benefits that can be expected from each project. These benefits and the associated project costs are then used along with local input as a guide prioritizing projects.

The following measures were used to estimate the benefits that would be derived from each project: (1) reduced road user costs, (2) increased economic development resulting from the improvement, and (3) the positive and negative environmental impacts. The first measure is an estimate of actual dollar savings, while the others are estimates of the impacts of the resulting change.

Road user benefits can result from most roadway improvements. These benefits are achieved through reductions in vehicle operating costs, travel time, and accident costs. The total dollar savings are summed over the design period.

The economic development potential of a project is the probability that it will stimulate development in an area by reducing transportation costs and providing access to productive land. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land use. Table 6 shows this rating on a scale from 0 (no impact) to 1.00 (excellent impact):

**Table 6**  
**Economic Development Potential**

Subjective Evaluation	Success or Impact Probability
Excellent, highest	1.00
Very good, very substantial	0.75
Good, substantial, considerable	0.50
Fair, some	0.25
Poor, none	0.00

Estimation of environmental impacts on the project is based on the physical, social and/or cultural, and economic impacts of a project. Table 7 lists these impacts. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project.

**Table 7**  
**Type of Environmental Impacts**

<b>Physical Environment</b>	<b>Social and Cultural Environment</b>	<b>Economic Environment</b>
Air Quality	Housing Neighborhoods	Businesses
Water Resources	Noise	Employment
Soils and Geology	Educational Facilities	Economic Development
Wildlife	Churches	Public Utilities
Vegetation	Parks and Recreational Facilities	Transportation Costs
	Public Health and Safety	Capital Costs
	National Defense	Operation and Maintenance Costs
	Aesthetics	
	Historic Sites and Landmarks	

The Threatened and Endangered Species Act of 1973 allows the US Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, impacts can be avoided or minimized. For more information on environmental concerns, refer to Appendix D of this report.

The costs estimated in this report are based on the average statewide construction costs for similar project types. Table 8 evaluates the major proposed projects in the planning area with respect to user benefits, estimated costs, probability of economic development and environmental impacts.



Table 8  
Benefits Evaluation of Selected Thoroughfare Plan Projects

Project	Total Length Miles [Km]	30-year Accrued Benefits (\$ Millions)	Project Cost (\$ Millions)	Economic Development Potential	Environmental Impact Probability
NC 133, Widen to 5 lanes from NC 211 to SR 1210	2.15 [3.46]	32.6	9.1	0.36	+ 0.4 - 0.4
NC 211, Widen to 4-lane divided facility from SR 1500 to Eastern Planning Boundary (CP&L Bridge)	6.60 [10.62]	13.9	18.6	0.72	+ 0.5 - 0.4
SR 1190 (Oak Island Dr), Widen to 3 lanes from 29th Street to SR 1105	1.85 [2.98]	5.1	5.2	0.30	+ 0.3 - 0.5
TIP Project R-3324 (Doshier Cutoff Bypass), New Route from NC 133/ NC 211 to NC 87/133	1.20 [1.93]	74.7	5.0	0.60	+ 0.5 - 0.5

Many considerations go into the evolution of a project from initial idea to construction. Political, social, environmental, and economic considerations have varying amounts of influence at different points in time. For this reason, the adoption of a thoroughfare plan does not explicitly include priorities. Implementation of the thoroughfare plan is the responsibility of the local areas. Table 8 can be used by the local areas to set a priority project list.





## Appendix A

### Typical Cross Sections, Thoroughfare Plan Street Tabulation, and Recommendations

## Appendix A

Through the Plan Stress Evaluation and Recommendations



## Typical Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired LOS, and available right-of-way (ROW).

Typical cross sections recommended by the Statewide Planning Branch are shown in Figure 12. These cross sections are typical for facilities at new locations and where ROW constraints are not critical. For widening projects and urban projects with limited ROW, special cross sections should be developed that meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available ROW.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate ROW should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed here. Recommendations for "ultimate" cross sections are provided for:

- 1) thoroughfares requiring widening after the current planning period;
- 2) thoroughfares which are borderline adequate, where accelerated traffic growth could render them deficient; and
- 3) thoroughfares where an urban curb-and-gutter cross section may be locally desirable because of urban expansion or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related superelevation, and other considerations for thoroughfares are given in Appendix D.

### *A - Four Lanes Divided with Median, Freeway*

This cross section is typical for four-lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 14 m (46 feet), but a wider median is desirable.

### *B - Seven Lanes, Curb & Gutter*

This cross section is not recommended for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as widening from a five lane section when ROW is limited. Even in these situations, consideration should be given to



converting the center turn lane to a median so that cross section "D" is the final cross section.

*C - Five Lanes, Curb & Gutter*

Typical for major thoroughfares, this cross section is desirable where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

*D - Six Lanes Divided with Raised Median, Curb & Gutter*

*E - Four Lanes Divided with Raised Median, Curb & Gutter*

These cross sections are typically used on major thoroughfares where left turns and intersection streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

*F - Four Lanes Divided, Boulevard, Grass Median*

Recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

*G - Four Lanes, Curb & Gutter*

This cross section is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and ROW is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If ROW is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

*H - Three Lanes, Curb & Gutter*

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require this cross section.

*I - Two Lanes, Curb & Gutter with Parking on Both Sides*

*J - Two Lanes, Curb & Gutter with Parking on One Side*

Cross sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "I" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.



#### *K - Two Lanes, Paved Shoulder*

This cross section is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full ROW of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m. In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m will be reserved by use of building setbacks and future street line ordinances.

#### *L - Six Lanes Divided with Grass Median, Freeway*

Cross section "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

#### *M - Eight Lanes Divided with Raised Median, Curb & Gutter*

Also used for controlled access freeways, this cross section may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

#### *N - Five Lanes, Curb & Gutter, Widened Curb Lanes*

#### *O - Two Lanes, Shoulder Section*

#### *P - Four Lanes Divided with Raised Median, Curb & Gutter, Widened Curb Lanes*

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities.

#### *Other General Information*

The urban curb & gutter cross sections illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum ROW line. This permits adequate setback for utility poles. If the sidewalk is moved farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The rights-of-way shown for the typical cross sections are the minimum required to contain the street, sidewalks, utilities, and drainage facilities. Additional cut and fill may require additional ROW or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

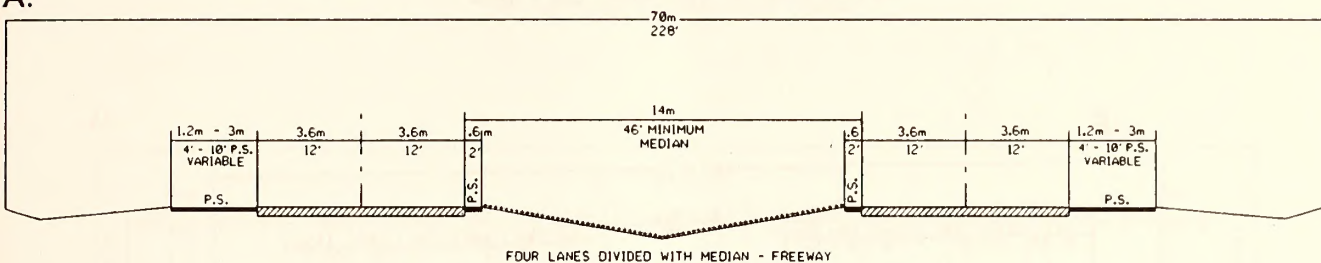
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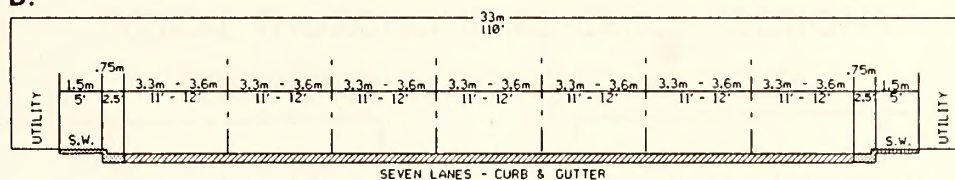
# FIGURE 12

## TYPICAL THOROUGHFARE CROSS SECTIONS

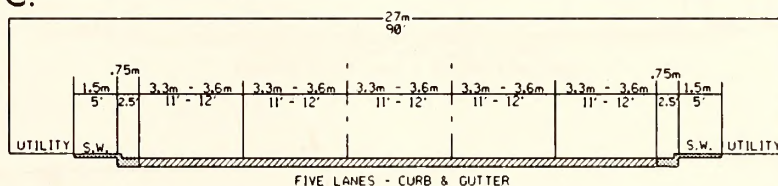
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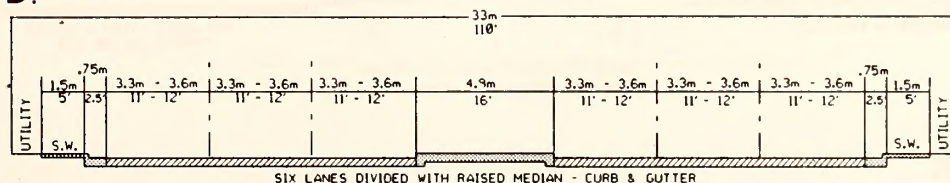
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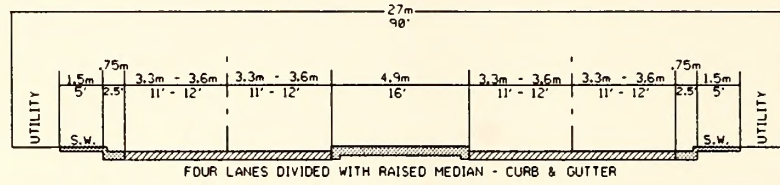


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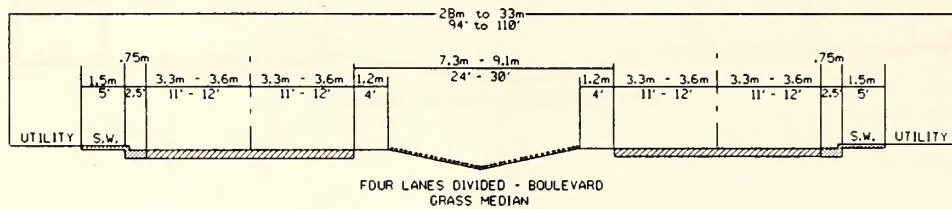


# TYPICAL THOROUGHFARE CROSS SECTIONS

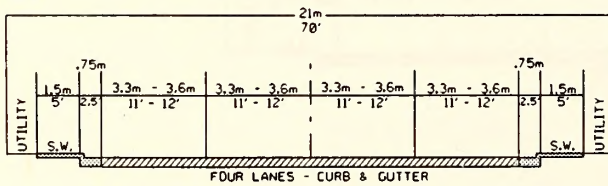
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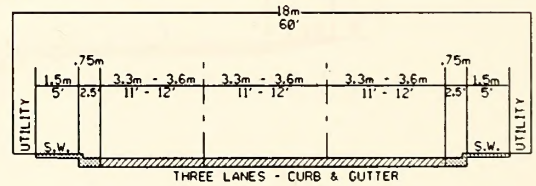
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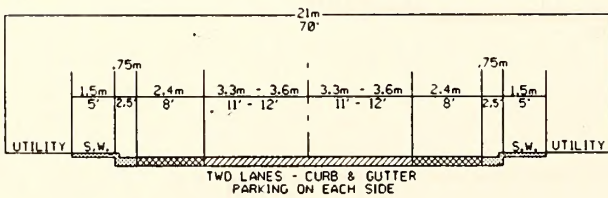
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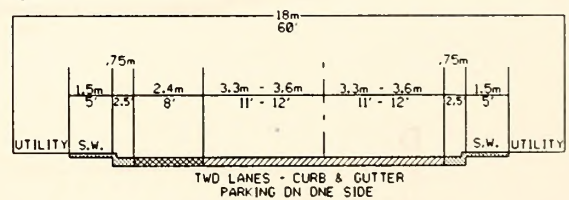
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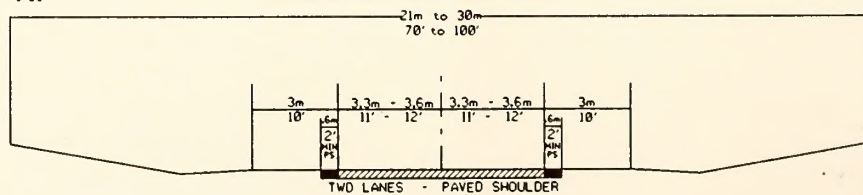
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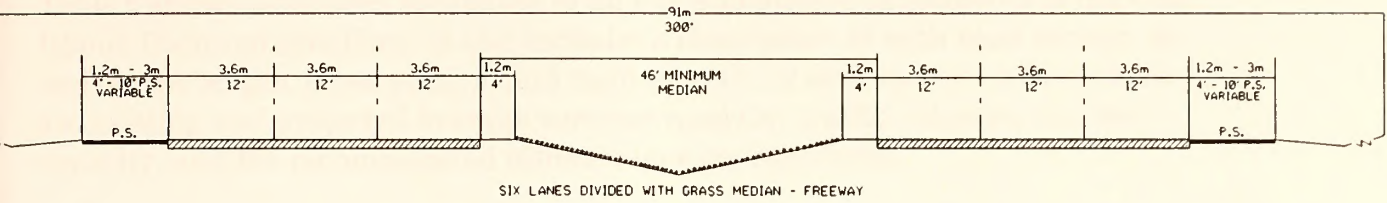
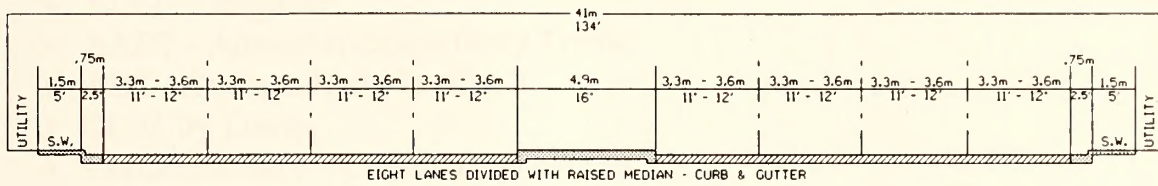
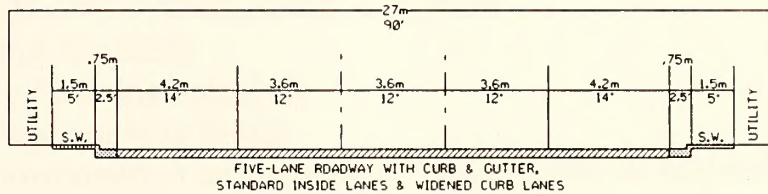
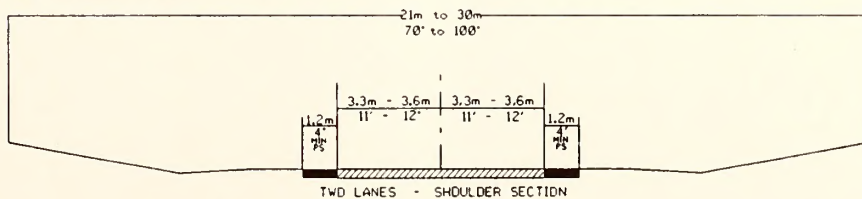
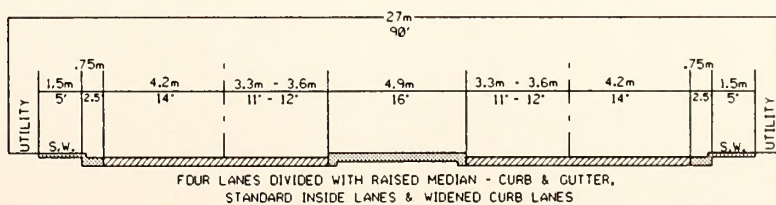
J.



K.





**FIGURE 12****TYPICAL THOROUGHFARE CROSS SECTIONS****M.****TYPICAL THOROUGHFARE CROSS SECTIONS  
FOR ACCOMMODATING BICYCLES****N.****O.****P.**





## Thoroughfare Plan Street Tabulation and Recommendations

Table 5 shows a detailed tabulation of all roads identified as elements of the Oak Island Thoroughfare Plan. It also includes a description of each road section, as well as the length, cross-section, and right-of-way for each section. Also included are existing and projected average summer weekday traffic volumes, roadway capacity, and the recommended ultimate lane configuration.

The following index of abbreviations may be helpful in interpreting Table 5:

- ADQ - Adequate
- AADT - Annual Average Daily Traffic
- ADT - Average Daily Traffic
- CL - City Limits
- Cst Guard Stion - Coast Guard Station
- int., ints. - intersection
- IWW - Intercoastal Waterway
- km - kilometers
- km/h - kilometer per hour
- m - meters
- mi - miles
- N--, S--, E--, W-- - North, South, East, West
- N/A - Not Available
- P. Bndy - Planning Boundary
- ROW - Right of Way Width
- TIP - Transportation Improvement Program (refer to Appendix C for further explanation)
- UNK - Unknown
- vpd - Vehicles per Day





Table 9

Oak Island Thoroughfare Plan Chart

Facility and Section		Distance (km)		Existing Road Section (1995)			Future Road Section (2025)			2025 Recommended Cross Section	
from	to			Roadway (m)	Lanes	ROW (m)	Capacity (vpd)	ADT (vpd)	Capacity (vpd)	ADT (vpd)	ADT w/TIP Proj (vpd)
NC 133											
SR 1190	Ypn. Beach NCL (56.3 km/h)	0.47		9.8	3	18.3	13800	15500	13800	28000	19100
	End of IWW Bridge	1.30		12.8	3	30.5	15500	15500	15500	28000	19100
	Common Lane	0.32		12.2	2	30.5	13000	-----	13000	-----	-----
	NC 211 (concurrent)	3.46		12.2	3	18.3	15500	14000	26850	27350	23200
NC 211	0.24 km E w/in NC 133/211 int	0.24		12.2	3	30.5	15000	17450	32500	32000	29000
	0.24 km W Dutchman Ck Brg	0.24		6.1	2	18.3	11000	20000	32500	32000	30000
	0.08 km W NC 211	0.48		6.7	2	45.7	12000	20000	32500	32000	30000
	Boundary	0.24		6.7	2	18.3	12000	5900	13000	16500	9000
NC 211 (Supply-Southport Rd)	(88.5 km/h)										
0.32 km E SR 1112	0.24 km W SR 1500	5.31		8.5	2	45.7	15000	5400	15000	13900	15000
0.24 km W SR 1500	0.24 km E SR 1500	0.48		11.0	3	45.7	23200	5400	23200	13900	20900
0.24 km E SR 1500	0.24 km W St. James Ent	3.54		24.0	2	45.7	13000	7800	32500	22050	25050
0.24 km W St. James Ent	0.16 km E St. James Ent	0.40		11.0	3	45.7	23200	7800	32500	22050	25050
0.16 km E St. James Ent	SR 1549 (72.4 km/h)	4.34		24.0	2	45.7	13000	7800	32500	22050	25050
SR 1549	NC 133	0.64		11.0	3	45.7	23200	7800	32500	22050	25050
	[Concurrent with NC 133]	0.96		-----	-----	-----	-----	-----	-----	-----	-----
NC 133	CP&L Bridge (Boundary)	0.24		6.7	2	45.7	12000	11200	32500	23950	23950
Caswell Road (SR 1100) (56.3 km/h)											
Rapist Assembly/CL Caswell Bch	CL Caswell Bch (Cat Guard Stion)	0.72		6.1	2	18.3	11000	-----	13000	-----	-----
CL Caswell Bch	CL Caswell Bch (56.3 km/h)	1.29		6.1	2	18.3	11000	-----	13000	-----	-----
CL Caswell Bch	Yaupon Beach ECL	2.33		6.1	2	18.3	11000	-----	13000	-----	-----
Yaupon Beach ECL	NC 133	0.88		6.1	2	18.3	11000	2200	13000	2600	2600
Beach Drive (SR 1104) (56.3 km/h)											
SR 1190	0.40 km S SR 1190	0.40		6.1	2	18.3	13000	900	13000	1700	1700
0.40 km S SR 1190	SR 1105	4.99		6.1	2	18.3	13000	-----	13000	1700	1700
SR 1105	0.08 km W 39th Pl W (72.4 km/h)	3.38		9.1	2	18.3	14000	1200	14000	2600	2600
0.08 km W 39th Pl W	0.08 km E 57th Pl W (56.3 km/h)	1.37		9.1	2	18.3	13000	-----	13000	2600	2600
0.08 km E 57th Pl W	SR 1828	0.56		6.1	2	18.3	13000	200	13000	400	400
SR 1828	Dead End (Harbor)	0.72		6.1	2	18.3	13000	-----	13000	400	400
Middleton Road (SR 1105)											
SR 1190	North End of Bridge	0.32		6.1	2	30.5	11000	900	13000	2200	2200
North End of Bridge	SR 1104	0.32		6.1	2	15.2	11000	900	13000	2200	2200
Mosquito Branch Road (SR 1111) (dirt road)											
NC 211	Dead End	0.40		10.0	2	N/A	6000	-----	10000	N/A	N/A
Yaupon Drive/Oak Island Drive (SR 1190) (56.3 km/h)											
NC 133/ SR 1100	ECL Long Beach	1.13		11.0	3	N/A	13800	11300	13800	22450	13000
ECL Long Beach	SR 1104	1.69		11.0	3	N/A	13800	11300	13800	22450	13000
SR 1104	0.97 km W SR 1104	0.97		11.0	3	N/A	13800	-----	13800	21700	13500
0.97 km W SR 1104 (72.4 km/h)	NE 29th	1.61		11.0	3	N/A	13800	-----	13800	21700	13500
NE 29th St	0.24 km E SR 1105	2.58		6.1	2	N/A	13800	-----	13800	16200	13500
0.24 km E SR 1105	SR 1105	0.24		11.0	3	N/A	13800	-----	13800	16200	13500
SR 1105	0.16 km W SR 1105	0.16		11.0	3	N/A	13800	-----	13800	16200	13500
0.16 km W SR 1105	Yacht Dr	2.67		6.1	2	N/A	13800	-----	13800	N/A	N/A

ADQ\*: Check recommendations for Airport Area Chapter  
Special: Check for Driveway Access Improvement recommendations in Chapter 4

Cross Section\*: refer to Typical Thoroughfare Cross Sections in this Appendix  
For metric conversions, refer to the NCDOT Metric Roadway Conversions Table in Appendix F.





## Appendix B

### Thoroughfare Planning Principles

## Appendix B

### Thoroughfare Planning Principles



## THOROUGHFARE PLANNING PRINCIPLES

The primary mission of thoroughfare planning is to assure that the road system will be progressively developed to serve future travel desires. Therefore, provisions are made for street and highway improvements so that when the need arises, feasible opportunities to make improvements exist.

### **Benefits of Thoroughfare Planning**

The two major benefits derived from thoroughfare planning are: (1) the design of each road or highway to perform a specific function and provide a specific level of service, and (2) the reporting of future improvements to local officials for their possible incorporation into planning and policy decisions. Roads performing a specific function allows for savings in right-of-way, construction, and maintenance costs. Providing a specific level of service for roads allows for protection of residential neighborhoods and encouragement of stability in travel and land use patterns. Informing local officials of the thoroughfare plan:

- (1) permits developers to design subdivisions in a non-conflicting manner,
- (2) directs school & park officials to better locations of their facilities, and
- (3) minimizes the damage to property values and community appearance sometimes associated with roadway improvements.

### **Classification of Thoroughfares**

Streets give traffic service and land access to the public. The fact that streets combine these two functions together creates conflict due to the incompatibility of these functions. The conflict is not serious if both traffic and land service demands are low. High demands and uncontrolled, intensely developed abutting property, however, create intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets, permitting travel from origins to destinations with directness, ease and safety. Different streets in this system are designed and are essential to perform specific functions, thus minimizing the traffic and land service conflict.

#### *Urban Classification*

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets.



Major Thoroughfares are the primary traffic arteries of the urban area providing for traffic movements within around, and through the area. Minor Thoroughfares are designed to collect traffic from the local access streets and carry it to the major thoroughfare system. Local Access Streets provide access to abutting property. Local streets may be further classified as either residential commercial and/or industrial depending upon the type of land use that they serve.

### **Idealized Major Thoroughfare System**

The coordinated system of major thoroughfares that is most adaptable to the desired lines of travel within an urban area and that is reflected in most urban area thoroughfare plans is the radial-loop system. The radial-loop system includes radials, crosstowns, loops, and bypasses.

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. A system of crosstown streets forming a loop around the central business district would avoid this problem. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

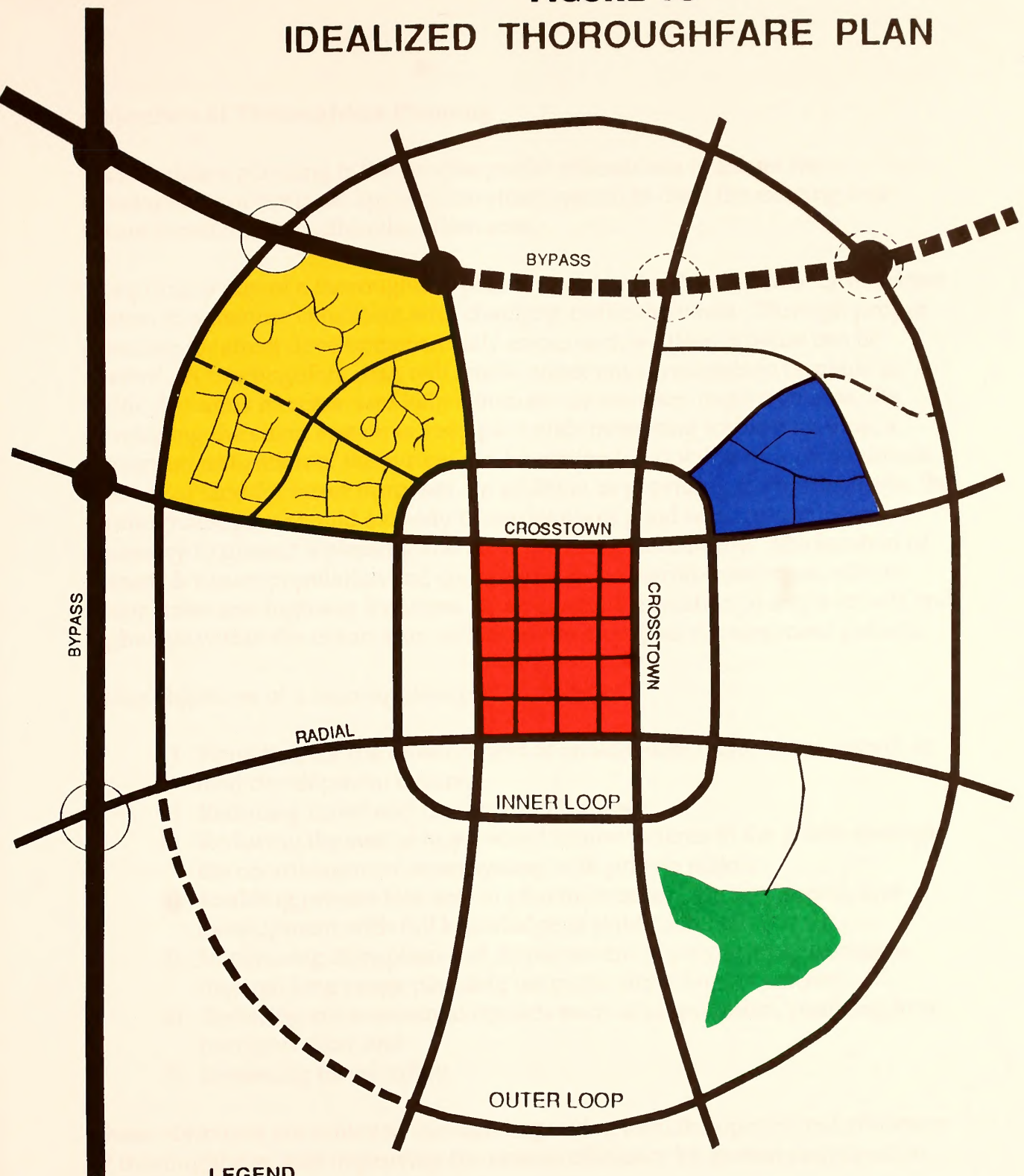
Loop system streets move traffic between suburban area of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets can carry heavy volumes of traffic; their major function is to help relieve central areas. Depending on the size of the urban area, more than one loop street may be needed. If this is the case, the loop streets are generally spaced 1/2-mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic that has no desire to be in the city. Designed at through-highway standards, access to the bypasses are restricted. Some bypasses with low volumes can function as part of an urban loop. Bypasses are created to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area. Figure 13 shows an idealized thoroughfare plan map.



# FIGURE 13

## IDEALIZED THOROUGHFARE PLAN



### LEGEND

	EXISTING	PROPOSED		LAND USES
MAJOR THOROUGHFARE FREEWAY				COMMERCIAL/BUSINESS
MAJOR OTHER				RESIDENTIAL
MINOR THOROUGHFARE				INDUSTRIAL
LOCAL ROAD				PUBLIC/INSTITUTIONAL
INTERCHANGE				
GRADE SEPERATION				





## **Objectives of Thoroughfare Planning**

Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system to meet the existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the street system in a manner consistent with changing traffic demands. Through proper planning for street development, costly errors and needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and help eliminate unnecessary improvements. By developing the street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present & future population and commercial & industrial enterprises, affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

- 1) Providing for the development of an adequate major street system as land development occurs;
- 2) Reducing travel and transportation costs;
- 3) Reducing the cost of major street improvements to the public through the coordination of street system with private action;
- 4) Enabling private interests to plan their action, improvements, and development with full knowledge of public intent;
- 5) Minimizing disruption and displacement of people and businesses through long range planning for major street improvements;
- 6) Reducing environmental impacts such as air pollution, resulting from transportation; and
- 7) Increasing travel safety.

These objectives are achieved through improving both the operational efficiency of thoroughfares, and improving the system efficiency by system coordination and layout.

### **Operational Efficiency**

A street's operational efficiency is improved by increasing the ability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is the maximum number of vehicles that can pass a point on a roadway



during a given period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include:

Street Widening: widening a street from two to four travel lanes at least doubles the capacity by providing additional maneuverability for traffic.

Intersection Improvements: the increase of the turning radii, the addition of exclusive turn lanes, and the channelization of movements improve the capacity of an existing intersection.

Improving vertical and horizontal alignment: this reduces the congestion caused by slow moving vehicles.

Eliminating roadside obstacles: this reduces side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

Control of access: a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

Parking relocation: Relocating on-street parking to an off-street site increases capacity by providing added street width for traffic flow and reducing friction to traffic flow caused by parking and unparking vehicles.

One-Way operation: the capacity of a street can be increased 20-50% (depending upon turning movements and street width), by initiating one-way traffic operations. One-way streets improve traffic flow by reducing potential traffic conflicts and simplifying traffic signal coordination.

Reversible Lanes: may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

Signal phasing and coordination: uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Travel demand can be altered to improve the efficiency of existing streets by:

Carpools: use of carpools can reduce the number of vehicles on the roadway and raise the people-carrying capability of the street system.

Alternate mode: alternate travel modes (i.e., transit, bicycles) can be used.

Work hours: industries, businesses and institutions staggering work hours or creating variable work hours for employees will reduce travel demand in peak periods and spread peak travel over a longer period.

Land use: a more travel-efficient land use development or redevelopment should be encouraged.



## **System Efficiency**

Another means of altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

## **Application of Thoroughfare Planning Principles**

The concepts presented in the discussion of operational efficiency, system efficiency, function classification, and idealized major thoroughfare system are some tools available to the transportation planner to develop a thoroughfare plan. In truth, thoroughfare planning is done for existing urban areas and curbed by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and many other factors that affect major street locations.

Throughout the thoroughfare planning process, certain basic principles must be followed as closely as possible from a practical viewpoint. These principles are:

- 1) The plan should be derived from a thorough knowledge of today's travel, its features, and any contributing, limiting, or modifying factors.
- 2) Traffic demands must be sufficient to the kind and development of each major street. The thoroughfare plan should allow for a large portion of major traffic movements on a few streets.
- 3) The plan should adapt and cater to the area land development plan.
- 4) Urban development beyond the current planning period must be considered. In outlying or sparsely developed areas with development potential, thoroughfares must be denoted on a long-range planning basis to protect rights-of-way for future thoroughfare development.
- 5) While being consistent with the above principles and realistic with travel trends, the plan must be economically feasible.





## Appendix C

### Implementation Of The Thoroughfare Plan





Once the thoroughfare plan has been developed and adopted, implementation is essential. Unless implementation is an integral part of the thoroughfare plan process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the three towns of Oak Island to assist in the implementation of the thoroughfare plan for this area. They are listed below.

### **State-Municipal Adoption of the Thoroughfare Plan**

The first step in the implementation process is the mutual adoption of the thoroughfare plan, as shown in Figure 2, by the municipalities and the North Carolina Department of Transportation. Caswell Beach, Long Beach, and Yaupon Beach have each adopted the Oak Island Thoroughfare Plan. The mutually approved plan serves as a guide for the Department of Transportation in the development of the road and highway system for the planning area. The approval of the plan by each Town also enables standard road regulations and land use controls to be used effectively in the incorporation of this plan.

State-maintained facilities will be constructed and maintained by the Divisions of Highways; municipal-maintained facilities will be constructed and maintained by the municipality.

To neglect the implementation process is a three-fold loss: the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly, the loss of the benefits to accrue from an improved transportation system.

### **Subdivision Controls**

Subdivision regulations require every subdivider to submit to the Town Planning Commission a plan of any proposed subdivision. The regulations also require that these areas be constructed to certain standards. Through this process, it is possible to require subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become part of the thoroughfare plan. The adequate construction of subdivision streets reduces maintenance costs and simplifies the transfer of streets to the State Highway System.

Projects in the planning area that could be fulfilled or protected by subdivision ordinances are the NC 133 and NC 211 widenings, Oak Island Drive widening, and any bicycle accommodations and improvements. Appendix D outlines the recommended subdivision design standards pertaining to road construction.



## **Zoning Controls**

A zoning ordinance can be beneficial to thoroughfare planning by designating appropriate locations of various land uses and allowable densities of residential development. This provides a degree of stability on which to make future traffic projections and to plan streets and highways.

Other benefits of a good zoning ordinance are: (1) the establishment of standards of development which will aid traffic operations on major thoroughfares; and (2) the minimization of strip commercial developments which creates traffic friction and increases the traffic accident potential.

The zoning ordinances of each Oak Island town should be structured to control strip development along the thoroughfares. Strip development along Oak Island Drive (Yaupon Drive/Oak Island Drive) has already increased and can be controlled by each town's ordinances. NC 133, north of the existing Oak Island Bridge, has strip development along it as well. Brunswick County's zoning ordinances, however, will have to rule in this area, as well as in the NC 211 / Midway Road area. A proposed shopping center in this area could spur more development. Continuing to allow this type of development without strict zoning controls will increase congestion on this facility.

## **Land Use Controls**

Land use regulations help to regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by encouraging off-street parking and sufficient setbacks to provide for adequate sight distances. Right-of-way cost dedications and reservations play major roles in the ultimate cost of many facilities. In few cases will the municipality be able to enjoy the benefits of highway improvement without some form of investment.

These regulations would be applicable to facilities that are recommended to be widened to multiple lanes, such as NC 133 from NC 211 to Old Bridge Road and NC 211 from Midway Road to the eastern planning boundary (CP & L Bridge). Land use controls can help ensure that these facilities will maintain their intended capacities by regulating the types of land use that develop along the roads.

## **Development Reviews**

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and the Traffic Engineering Branch of the North Carolina Department of Transportation. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff of the NCDOT Traffic



Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Branch. If done at an early stage, it is often possible to improve the accessibility of the growth area while preserving the integrity of the thoroughfare plan.

NC 211 should experience increased development throughout the planning period. The Second Oak Island Bridge and the NC 87 to NC 133 Connector, should experience increased development after their construction is complete. Use of development regulations can help control increasing traffic and congestion along these roads.

## **Funding Sources**

### *Capital Improvements Program (CIP)*

A Capital Improvement Program for transportation is a long-range plan for spending money on street improvements, acquisition of rights-of-way and other improvements on the basis of projected revenues. Municipal funds should be available for construction of street improvements that are a municipal responsibility, right-of-way cost sharing on facilities designated as a Division of Highways responsibility, and advance purchase of right-of-way where such action is warranted. However, NC House Bill 1211 limits the role of municipalities to specific limits in project cost sharing.

### *Transportation Improvement Program (TIP)*

NCDOT's Transportation Improvement Program is a document listing all major construction projects NCDOT plans for the next seven years. Similar to local CIP projects, TIP projects are matched with projected funding sources. Every two years when the TIP is updated, completed projects are removed, programmed projects are advanced, and, if funding is available, new projects are added.

During TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation (NCBOT) member reviews project requests in a particular area of the state. The board member chooses projects to be included in the TIP based on their technical feasibility, need, and available funding. TIP Funds are available for highway construction, widening, bridge replacement projects, highway safety and bicycle projects, public transit projects, railroad projects.

### *Industrial Access Funds*

If an industry wishes to develop property that does not have access to a state-maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

### *Small Urban Funds*

Small Urban Funds are available to municipalities with qualifying projects. Requests for Small Urban Fund assistance should be directed to the NCBOT member or NCDOT Division Engineer for Division 3.

### *Powell Bill Program*

The Powell Bill (General Statutes 136-41.1 through 136-41.3) allocates funds to qualified incorporated cities and towns for the maintenance, construction, and reconstruction of local streets that are the responsibility of the municipalities. In 1996, Yaupon Beach, Caswell Beach, and Long Beach were allocated \$38,240.83, \$5,120.62, and \$254,591.61, respectively.

### **The North Carolina Highway Trust Fund Law<sup>C-1</sup>**

The Highway Trust Fund Law was established in 1989 as a 13.5-year plan with four major goals for North Carolina roads and highways. These goals are:

- 1) to complete the remaining 2,768 km (1,716 mi) of four-lane construction on the 5,800 km (3,600 mi) North Carolina Intrastate System.
- 2) to construct a multilane connector in Asheville and parts of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.
- 3) to supplement the secondary roads appropriation in order to pave, by 1999, 16,100 km (10,000 mi) of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.
- 4) to supplement the Powell Bill Program.

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<sup>C-1</sup> For more information on the Highway Trust Fund Law, contact the Program Development Branch of the NCDOT.



## Appendix D

### Environmental Concerns

#### Background

- 1. The proposed project is located in a sensitive area.
- 2. The project area is adjacent to a protected area.
- 3. The project area is adjacent to a protected area.
- 4. The project area is adjacent to a protected area.
- 5. The project area is adjacent to a protected area.
- 6. The project area is adjacent to a protected area.
- 7. The project area is adjacent to a protected area.
- 8. The project area is adjacent to a protected area.
- 9. The project area is adjacent to a protected area.
- 10. The project area is adjacent to a protected area.

#### Findings

- 1. The project area is adjacent to a protected area.
- 2. The project area is adjacent to a protected area.
- 3. The project area is adjacent to a protected area.
- 4. The project area is adjacent to a protected area.
- 5. The project area is adjacent to a protected area.
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- 7. The project area is adjacent to a protected area.
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## Appendix A

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## Appendix B

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## Appendix C

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## Appendix D

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Environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the creation of an environmental impact statement (EIS) for road projects having a significant impact on the environment. Included in an EIS would be the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below.

### Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973 allows the US Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we are able to avoid or minimize these impacts.

The North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR) was the source of the name and type of each endangered species and natural area or community that existed in Brunswick County and the Oak Island Planning Boundary. Six animals, thirty-two plants, and eleven natural areas or communities were identified as rare or significant within the Oak Island Planning Boundary. The following is a list of the federally and state protected species located in the Oak Island planning boundary.

#### Rare animals

Alligator mississippiensis (American alligator)	TF
Anhinga anhinga (Anhinga)	
Aimophila aestivalis (Bachman's Sparrow)	
Ammodramus henslowii (Henslow's Sparrow)	
Caretta caretta (Loggerhead Turtle)	
Charadrius melodus (Piping Plover)	
Lepidochelys kempii (Atlantic Ridley)	
Ophisaurus mimucus (Mimic Glass Lizard)	
Planorbella magnifica (Magnificent Ramshorn Snail)	E
Picodes borealis (Red-cockaded Woodpecker)	EF
Rana capito capito (Carolina Gopher Frog)	

#### Rare plants

Agalinis aphylla (Scale-leaf Gerardia)
Agalinis linifolia (Flaxleaf Gerardia)
Amaranthus pumilius (Seabeach Amaranth)
Amorpha georgiana var. confusa (Savanna Indigo-bush)
Amphicarpum purshii (Pinebarrens Goober Grass)



<i>Aristida palustris</i> (Longleaf Three-awn)	
<i>Asclepias pedicellata</i> (Savanna Milkweed)	
<i>Baccharis glomeruliflora</i> (Silverling)	
<i>Bulbostylis warei</i> (Ware's Hairsedge)	
<i>Campylopus carolinae</i> (Savanna Campylopus)	
<i>Carex chapmanii</i> (Chapman's Sedge)	T
<i>Cyperus dentatus</i> (Toothed Flatsedge)	
<i>Cyperus lecontei</i> (Leconte's Flatsedge)	
<i>Dichanthelium erectifolium</i> (Erectleaf Witchgrass)	
<i>Dionaea muscipula</i> (Venus Flytrap)	
<i>Drosera filiformis</i> (Threadleaf Sundew)	
<i>Eleocharis melanocarpa</i> (Blackfruit Spikerush)	
<i>Erythrina herbacea</i> (Coralbean)	
<i>Fimbristylis perpusilla</i> (Harper's Fringe Rush)	T
<i>Galactia mollis</i> (Soft Milk-pea)	
<i>Helenium pinnatifidum</i> (Dissected Sneezeweed)	
<i>Helianthemum georgianum</i> (Georgia Sunrose)	
<i>Ipomoea imperati</i> (Beach Morning Glory)	
<i>Lachnocaulon beyrichianum</i> (Southern Bogbutton)	
<i>Lechea torreyi</i> (Torrey's Pinweed)	
<i>Lilaeopsis carolinensis</i> (Carolina Grasswort)	T
<i>Litsea aestivalis</i> (Pondspice)	
<i>Ludwigia lanceolata</i> (Lanceleaf Seedbox)	
<i>Ludwigia suffroticosa</i> (Shrubby Seedbox)	
<i>Lysimachia asperulifolia</i> (Rough-leaf Loosestrife)	EF
<i>Macbridea caroliniana</i> (Carolina Bogmint)	
<i>Myriophyllum laxum</i> (Loose Watermilfoil)	T
<i>Oxypolis ternata</i> (Savanna Cowbane)	
<i>Panicum tenerum</i> (Southeastern Panic Grass)	
<i>Parnassia caroliniana</i> (Carolina Grass-of-parnassus)	E
<i>Peltandra sagittifolia</i> (Spoonflower)	
<i>Plantago sparsiflora</i> (Pineland Plantain)	E
<i>Rhexia aristosa</i> (Awned Meadow-beauty)	T
<i>Rhexia cubensis</i> (West Indies Meadow-beauty)	
<i>Rhynchospora odorata</i> (Fragrant Beaksedge)	
<i>Rhynchospora oligantha</i> (Feather-bristle beaksedge)	
<i>Rhynchospora pallida</i> (Pale Beakrush)	
<i>Rhynchospora pleiantha</i> (Coastal Beaksedge)	
<i>Rudbeckia heliopsisidis</i> (Sun-facing Coneflower)	T
<i>Sabal palmetto</i> (Cabbage Palm Tree)	
<i>Scleria georgiana</i> (Georgia Nutrush)	
<i>Scleria verticillata</i> (Savanna Nutrush)	
<i>Solidago pulchra</i> (Carolina Goldenrod)	
<i>Solidago verna</i> (Spring-flowering Goldenrod)	E
<i>Sphagnum fitzgeraldii</i> (Fitzgerald's Peatmoss)	



Sporobolus sp. 1 (Carolina Dropseed)  
Syngonanthus flavidulus (Yellow Hatpins)  
Tofieldia glabra (Carolina Asphodel)  
Trichostema sp. 1 (Dune Bluecurls)  
Tridens carolinianus (Carolina Triodia)  
Xyris brevifolia (Shortleaf Yellow-eyed grass)  
Xyris flabelliformis (Savanna Yellow-eyed Grass)  
Yucca gloriosa (Moundlily Yucca)

EF: seen as an endangered species by the State and Federal Governments.

An endangered species is one "in danger of extinction throughout all or a significant portion of its range."<sup>1</sup>

E: seen as an endangered species by the State Government only.

TF: seen as a threatened species by the State and Federal Governments.

A threatened species is one "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."<sup>1</sup>

T: seen as a threatened species by the State Government only.

(<sup>1</sup>Definitions are taken from the *Federal Register*, Vol. 56, No. 225, November 1, 1991 (50 CFR Part 17).)

The beach area can attract other water-borne animals and plants, which include endangered species. Any type of construction within the planning area can affect the habitat of these endangered animals and plants. The Second Oak Island Bridge construction will affect a number of habitats; for more information on the habitats affected by this project, refer to the NC DOT Environmental Assessment on the project (TIP Project R-2245). The NC 133 and NC 211 widenings may affect habitats of some endangered plants and animals. However, special care will be taken during the project planning stage of these projects to insure protection of the area.

## Wetlands

In general terms, wetlands are areas where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by erosion. They are also critical to fish and wildlife populations. Wetlands provided an important habitat for about one third of the land and animal species that are federally listed as threatened or endangered.

In this study, the impacts to wetlands were determined using the National Wetlands Inventory Mapping, available from the U.S. Fish and Wildlife Service.



Wetlands impacts should be avoided or minimized to the greatest extent possible while preserving the integrity of the transportation plan. The following is a list of federally and state protected areas located in the Oak Island planning boundary.

#### Endangered natural communities

- Salt Marsh
- Boiling Spring Lakes-Wetland Complex
- Wet Pine Flatwoods
- Pond Pine Woodlands
- Pine Savanna
- Coastal Fringe Evergreen Forest
- Vernal Pool
- Coastal Fringe Sandhill
- Sunset Harbor Ash Swamp
- Big Cypress Bay and Ponds
- Wading Bird Rookery

#### **Historic Sites**

The locations of historic sites in the Oak Island planning area were investigated to determine the possible impacts of the proposed transportation improvements. The federal government requires all State Departments of Transportation to make special efforts to preserve historic sites. Section 106 of the National Historic Preservations Act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The NC DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

In addition to federal guidelines, the State of North Carolina has issued its own guidelines for historic site preservation. The NC General Statute 121-12(a) requires the NC DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. NC DOT must consider impacts and consult with the NC Historical Commission, but it is not bound by their recommendations.

The three buildings or areas that are listed on the State Study List are:

- (1) the Fort Caswell Historic District, located at the end of SR 1100, at the eastern town limits of Caswell Beach
- (2) the Oak Island US Coast Guard Station, located along SR 1100, 0.3 mi from the eastern town limits of Caswell Beach, and
- (3) the Smithville Log House, located 0.2 mi east of the western NC 133/ NC 211 intersection, along NC 211



## Appendix E

### Public Involvement

The first part of the report is a summary of the work done during the year. It is followed by a detailed account of the work done in each of the four main areas of research.

## Summary of Work Done

- 1. The first part of the report is a summary of the work done during the year.
- 2. It is followed by a detailed account of the work done in each of the four main areas of research.
- 3. The first part of the report is a summary of the work done during the year.
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- 9. The first part of the report is a summary of the work done during the year.
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## References

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10. It is followed by a detailed account of the work done in each of the four main areas of research.



One of the goals of a thoroughfare plan is to conduct a study that (1) uses comprehensive and complete information, (2) is a never-ending or continuing process, and (3) shows cooperation with the town agencies and public. This appendix outlines the public involvement process undertaken.

### **Citizen Survey**

On September 25, 1996, NCDOT and the towns of Oak Island conducted a survey on growth issues and future development for the planning area. The survey, entitled *Goals and Objectives Survey-Oak Island Area*, was sent to 1000 property owners and received a response rate of almost 33%. While the survey focused on growth and development, there were several transportation-related questions.

When asked if providing better mainland access (i.e., Second Oak Island Bridge) was important to the Oak Island public, approximately 85% of respondents strongly wanted this bridge to be built. Of course, a large number of participants (approximately 85%) want to reduce traffic accidents. Eighty-one percent wanted to protect natural areas and open spaces, 77% wanted to improve evacuation routes and/or procedures, and 77% approved development only when and where adequate support services are available. Seventy-five percent felt that widening streets in existing neighborhoods to improve traffic flow was important. Finally, 66% of those polled stated that building bicycle lanes along the roads are important to the area. Because Oak Island is a beach area, provisions for bicycles are a priority of the planning area.

### **Meetings**

In March of 1995, the Town of Long Beach requested NCDOT to conduct an update study of the Thoroughfare Plan for the area. The Town also contacted Yaupon and Caswell Beaches town agencies in May for their inclusion in the study. NCDOT began working on the study in June.

From 1995 to the present, members of each town, the Brunswick County Planning Board, and the public have been contacted on a regular basis by the NCDOT Statewide Planning Branch to discuss the thoroughfare planning process and any recommendations that were needed for the Oak Island Planning Area.

In July 1995, NCDOT introduced the thoroughfare planning process at a Long Beach Planning Board Meeting. This meeting also included an overview of the proposed steps in the plan's development, along with a discussion of the various public involvement opportunities that are available for use.

Meetings were held with representatives from each town to discuss their traffic and town deficiencies. During these meetings, many issues were discussed, including:

- 1) Updates on the Second Oak Island Bridge and design of the project.
- 2) Year-round and peak seasonal populations.
- 3) Sewer and flooding problems.



- 4) Traffic and bicyclist concerns.
- 5) Erosion of existing roads.
- 6) Alternate hurricane routes.

The Oak Island Thoroughfare Plan Committee membership was formed with representatives from each town, NCDOT, and Brunswick County. Three committee meetings were held, where many issues were discussed (*responses, if any*):

- 1) A goals and objectives survey for the planning area.
- 2) Traffic impacts from surrounding towns. Some surrounding areas should be considered in the thoroughfare plan. *Boiling Spring Lakes and Southport requested separate thoroughfare plans; therefore, these areas are not included in the Oak Island Thoroughfare Plan.*
- 3) The Sanitary Sewer District and the Brunswick County Airport. *It was discovered later that the airport is planning to lengthen the runway across the Airport Road section closest to NC 133.*
- 4) The St. James Plantation and other developments.
- 5) Steps taken with the thoroughfare plan, and updates of this information.
- 6) Any base and design year deficiencies (considering traffic changes within the planning boundary once the Second Bridge is built).
- 7) Update on the channelization project in Long Beach.
- 8) Summer peak traffic counts and projections
- 9) Recommendations for the planning area
- 10) Information from a Steering Committee Meeting for the Second Oak Island Bridge that occurred July 1997 (This meeting brought together representatives from NC DOT, various engineering firms, various state agencies, and the Corps of Engineers to discuss the Environmental Assessment (EA) report on the 2<sup>nd</sup> bridge and any challenges the agencies felt existed).
- 11) Next steps, which were to meet with the planning boards/town commissioners, then hold public workshops/hearings.

From discussions and analyses of the transportation system in the county, a set of preliminary recommendations were developed. During the months of October 1997 through January 1998, meetings were held with the Long Beach Planning Board, and the Board of Commissioners from each town for presentation of a preliminary version of the thoroughfare plan for the planning area. The Long Beach Planning Board approved the changes to the Proposed Thoroughfare Plan and Recommended Improvement Maps to present them to the Long Beach Board of Commissioners.

The town officials and public agreed on most of the projects proposed. However, there were several additional requests and concerns discussed. These included the following (followed by *responses*):

- 1) The Caswell Beach Board of Commissioners spoke of a proposed



development that will be built along Old Bridge Road and across NC 133 from the Brunswick County Airport. For this reason, they suggested that the widening of NC 133 be extended down to Old Bridge Road. *NCDOT agreed and made this change in their recommendations.*

- 2) All agencies and citizens present stated that a signal should be installed at NC 133/211 (Doshier Cutoff Road) intersection, and that they did not trust the studies and traffic counts taken at this intersection. *NCDOT spoke with the NCDOT Division Traffic Engineer about signal installation at this location. The Division Traffic Engineer found that the signal was warranted, but the signal would not be installed until funding was available.*

On January 20, 1998, The Long Beach Board of Commissioners adopted the Recommended Thoroughfare Plan Map and recommended improvements with the following additions:

- 1) Yacht Drive from West Oak Island Drive to 58<sup>th</sup> Street should be designated as a minor thoroughfare.
- 2) 58<sup>th</sup> Street from Yacht Drive to Oak Island Drive should be designated as a minor thoroughfare.

The Yaupon Beach Board of Commissioners adopted the Thoroughfare Plan Map, with an addition to suggest that the Second Oak Island Bridge be built as a multi-lane facility (which includes the changes that the Long Beach Board of Commissioners suggested). The Caswell Beach Board of Commissioners adopted the Thoroughfare Plan Map as well.

NCDOT met with the Brunswick County Planning Board in February 1998 to update the Board on any changes to the Thoroughfare Plan and to present information on the thoroughfare planning process. An issue discussed was (followed by *responses*):

The Board questioned the need to widen NC 211 from Midway Road to the CP&L bridge when the second Oak Island bridge was designed to reduce the amount of traffic on Oak Island. *The traffic counts found along this NC 211 section warrant widening of the road, even with the Second Bridge Project construction. This widening also allows West Long Beach-bound traffic to use the Second Oak Island Bridge. More options are given to the traffic going from the planning area to Wilmington with these projects.*

### **Public Workshops/Hearings**

A public workshop was held for each town. Yaupon Beach held the first workshop in November 1997. One person from the public attended the workshop to ask for an update on the construction of the second Oak Island bridge. NCDOT informed the person that the project is due to begin construction during Fall of 1998. Caswell Beach followed with a public workshop during November 1997. Two people from



the public attended the workshop. NCDOT presented new information to the public and the Board of Commissioners:

- 1) NC 133 should be widened to a five-lane section from NC 211 to Old Bridge Road as a future need.
- 2) NC 211 should be widened to a four-lane section with a grass median from Midway Road to the CP&L Bridge (eastern planning boundary).
- 3) Yaupon Drive/Oak Island Drive should be widened to a three-lane section from 29<sup>th</sup> Street to Middleton Road. The section from NC 133 to 29<sup>th</sup> Street should not be widened to a four-lane section.

A public workshop was held for the town of Long Beach in January 1998.

Approximately ten people attended the workshop. Issues raised by the attendees (answers in *italics*) were:

- 1) Transit options. *The map depicting recommended improvements for bicycle accommodations explained any bicycle options that were available. The Brunswick County Airport has a project to lengthen its runway to the north by removing the section of Airport Road from NC 133 to approximately 0.2 mi (the first curve) and extending Airport Road to intersect Villanova Loop instead of NC 133. The date of construction is unknown.*
- 2) Dates on TIP projects. *NC DOT TIP Manuals depict when the construction, right-of-way, planning and design of any committed projects (e.g., the Second Oak Island Bridge) would occur.*
- 3) People of contact. *A contact sheet was made available for any people who can offer more insight into the thoroughfare plan and/or projects in the area.*
- 4) The status of a possible one-way pair project using Dolphin and Beach Roads. *Joel Cranford (of the Municipal Assistance and Intermodal Management Section of the NCDOT Traffic Engineering Branch) is working with Jerry Walters (Long Beach Town Manager) to begin studying the one-way pair project. This project, however, will not be shown on the thoroughfare plan map until a study is completed.*

A public hearing was held in January 1998 for the town of Long Beach as part of an NCDOT meeting with the Long Beach Board of Commissioners to update the Board on any changes to the Thoroughfare Plan, to present information on the process of thoroughfare planning, and to receive comments from the public. Over 50 people attended the hearing. The issues discussed during the public hearing were (followed by *responses*):

- 1) Consideration of the permanent Long Beach population in the population projection calculations. *NCDOT explained that the projections were based on population information from the Bureau of Census, the NC Office of State Planning, the land use documents for each town, and the town agencies themselves, which would consider permanent population of the town.*
- 2) The proposed route for the second Oak Island bridge. *It appears that one of the proposed routes, according to the public, does not consider the environmental impacts of the bridge onto the area. NCDOT stated that since the project is under study, the final alignment has not been determined.*



- 3) A citizen asked if any consideration has been given to a method that the state of Texas has used for hurricane evacuation (a narrow shoulder on highways, to be used for traffic in an emergency situation only). *NCDOT stated that this option had not been considered in the thoroughfare plan.*
- 4) A member of the Town Council asked why Yacht Drive is not included as a minor thoroughfare and that the road had been recently improved up to the Town of Long Beach thoroughfare standards. *NCDOT stated that Yacht Drive is a road that can bear a fairly large amount of traffic and is a road that can be added to the Plan as a minor thoroughfare.* A citizen stated that if 58<sup>th</sup> St from SR 1190 to Yacht Dr were added to the Plan as a minor thoroughfare, this would create a continuous path of thoroughfares, while aiding to alleviate traffic congestion on SR 1190. Another citizen did not believe Yacht Drive was designed to accommodate a high volume of traffic, due to its two lanes (and not being larger) and a narrower R/W than SR 1190. *Fifty-Eighth Street was added as a minor thoroughfare. NCDOT further stated that if Yacht Drive were added to the Plan, it would only be considered as a minor thoroughfare.*

### **Discussions with other Agencies**

Several phone discussions and letters were exchanged with representatives from the NC Natural Heritage Program, the Wilmington CP&L office, the NC Coastal Area Management Act Dept. of the NC Dept. of Environment, Health, and Natural Resources (NCDEHNR), the Brunswick County Planning Department, NC Cultural Resources-Archives and History Dept., and the NCDOT Traffic Engineering and Right-of-Way Departments. Many issues were discussed, including the following:

- 1) Endangered species and areas.
- 2) The location of CP&L's pumping station in Caswell Beach.
- 3) Proximity of Caswell Beach Road to the high tide line in Caswell Beach.
- 4) A driveway access improvement project in Long Beach.
- 5) Historic properties within the planning area.
- 6) Existing ROW along NC 133 (north of Intercoastal Waterway) and Yaupon Drive & Oak Island Drive. NC 133 has 60 feet of ROW from NC 211 to the existing Oak Island Bridge. Yaupon Drive & Oak Island Drive have at the most 60 feet of ROW from NC 133 to Middleton Road. The ROW is unknown in areas along Yaupon Drive & Oak Island Drive.

### **Conversations with the Public**

Information was received from many members of the public during the course of this study. They each expressed their concerns of proposed roads routed through areas that were of value to them. The thoroughfare planning process was explained by letter or by phone, as well as information from any of the public workshops and traffic volume study on the routes within the planning boundary.





## Appendix F

### Recommended Definitions and Design Standards for Subdivision Ordinances

## Appendix F

### Requirements of Conditions and Worker Standards for Substation Construction



## Definitions

### *Streets and Roads*

#### *Rural Roads*

1. Principal Arterial: A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.
2. Minor Arterial: A rural roadway joining cities and larger towns and providing intrastate and inter-county service at relatively high overall travel speeds with minimum interference to through movement.
3. Major Collector: A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.
4. Minor Collector: A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.
5. Local Road: A road which serves primarily to provide access to adjacent land, over relatively short distances.

#### *Urban Streets*

1. Major Thoroughfares: Those thoroughfares consisting of Interstate, Intrastate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.
2. Minor Thoroughfares: Those thoroughfares that perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.
3. Local Street: Any street not on a higher order urban system that serves primarily to provide direct access to abutting land.

#### *Specific Type Rural or Urban Streets*

1. Freeway, Expressway, or Parkway: Divided multilane highways designed to carry large volumes of traffic at higher speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally one with grade separations at major intersections. A parkway is for non-commercial traffic, with full or partial control of access.
2. Residential Collector Street: A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.
3. Local Residential Street: Cul-de-sacs, loop streets less than 750 m in length, or streets less than 1.5 km in length that do not connect thoroughfares, or serve



major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de sac: A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.
5. Frontage Road: A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.
6. Alley: A strip of land, owned publicly or privately, set aside primarily for vehicular service access to back sides of properties otherwise abutting on a st.

### ***Property***

#### ***Building Setback Line***

A line parallel to the street in front of which no structure shall be erected.

#### ***Easement***

A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

#### ***Lot***

A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

### ***Subdivision***

#### ***Subdivider***

Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

#### ***Subdivision***

All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose (immediate or future) of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets. The following shall not be included within this definition not subject to these regulations:

- 1) The combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein.
- 2) the division of land into parcels greater than four hectares where no street ROW dedication is involved
- 3) the public acquisition (by purchase) of strips of land for the widening or the opening of streets
- 4) the division of a tract in single ownership whose entire area is no



greater than 0.8 hectares into not more than three lots, where no street ROW dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

#### *Dedication*

A gift, by the owner, of his property to another party without any considerations being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

#### *Reservation*

Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

## **DESIGN STANDARDS**

### ***Streets and Roads***

The design of all roads within the Oak Island area shall be in accordance with the accepted policies of the NCDOT, Department of Planning and Environmental as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street ROW shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the Towns of Caswell Beach, Long Beach, and Yaupon Beach. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally, the proposed streets should be the extension of existing streets if possible.

#### ***Right-of-way Widths***

ROW widths shall not be less than those shown in the following table and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

The subdivider will only be required to dedicate a maximum of 30 meters (m) of ROW. In cases where the desired ROW is more than 30 m, the subdivider will be required only to reserve the amount in excess of 30 m. In all cases in which ROW is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width ROW (not less than 18 m in width) may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required ROW shall be dedicated.

**Table 10**  
**Minimum Right-of-Way Requirements**

Area Classification	Functional Classification	Minimum ROW(m)
Rural	Principal Arterial	Freeways: 105
		Other: 60
	Minor Arterial	30
	Major Collector	30
	Minor Collector	24
	Local Road <sup>1</sup>	18
Urban	Major Thoroughfare	27
	Minor Thoroughfare	21
	Local Street <sup>1</sup>	18
	Cul-de-Sac <sup>2</sup>	Variable

<sup>1</sup>The desirable minimum ROW is 18.3 m. If curb and gutter are provided, 15 m of ROW is adequate on local residential streets.

<sup>2</sup>The ROW dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to ROW should not be less than distance from edge of pavement to ROW on street approaching turnaround.

### ***Street Widths***

Street and road classification widths other than local shall be as the Thoroughfare Plan recommends. Local roads and streets width shall be as follows:

#### ***1) Local Residential***

Curb-and-gutter section: 7.9 m, face to face of curb

Shoulder section: 6.1 m to edge of pavement, 1.2 m for shoulders

#### ***2) Residential Collector***

Curb-and-gutter section: 10.4 m, face to face of curb

Shoulder section: 6.1 m to edge of pavement, 1.8 m for shoulders



### ***Geometric Characteristics***

The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under ROW shall apply.

- 1) *Design Speed*: The design speed for a roadway should be a minimum of 10 kph (5 mph) greater than the posted speed limit. The design speeds for subdivisions type streets are shown in Table 11.

**Table 11**  
**Design Speeds (in kph)**

Facility Type	Desirable Speed	Minimum Speed	
		Level	Rolling
<b>Rural Roads</b>			
Minor Collector	100	81	65
Local <sup>1</sup>	80	81	65
<b>Urban Roads</b>			
Major Thoroughfare <sup>2</sup>	100	81	65
Minor Thoroughfare	100	81	65
Local Street	65	65	48

### ***2) Maximum and Minimum Grades:***

- a) The maximum grades in percent are shown in the following table.
- b) Minimum grade should not be less than 0.5%.
- c) Grades for 30 meters each way from intersections (measured from edge of pavement) should not exceed 5%.
- d) For streets and roads with projected annual average daily traffic less than 250 vpd, short grades (less than 152 meters in length) may be 150% of the value in Table 12.

**Table 12**  
**Maximum Vertical Grade**

Facility Type	Design Speed (kph)	Minimum	Grade in	Percent
		Flat	Rolling	Mountainous
<b>Rural</b>				
Minor Collector Rds <sup>1</sup>	30	7	10	12
	50	7	9	10
	65	7	8	10
	80	6	7	9
	100	5	6	8
	110	4	5	6
Local Roads <sup>1,2</sup>	30	N/A	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	N/A
<b>Urban</b>				
Major Thoroughfares <sup>3</sup>	50	8	9	11
	65	7	8	10
	80	6	7	9
	100	5	6	8
Minor Thoroughfares <sup>1</sup>	30	9	12	14
	50	9	11	12
	65	9	10	12
	80	7	8	10
	100	6	7	9
	110	5	6	7
Local Streets <sup>1</sup>	30	N/A	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	N/A

<sup>1</sup>For streets and roads with projected annual average daily traffic less than 250 vpd or short grades less than 150 meters, grades may be 2% steeper than the values shown in the above table. (Reference: NCDOT Roadway Metric Design Manual, page 1-12, T-3)

<sup>2</sup>Local Roads include Residential Collectors and Local Residential.

<sup>3</sup>Major Thoroughfares other than Freeways or Expressways.



3) *Minimum Sight Distance*: In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the parameters shown in Table 13.

**Table 13**  
**Sight Distances**

Design Speed (kph)	50	65	80	100
<b>Stopping Sight Distance</b>				
Minimum	61	84	122	160
Desirable Minimum	61	99	145	198
<b>Minimum K<sup>1</sup> Value for:</b>				
Crest Curve	9	24	49	95
Sag Curve	12	21	34	49

Note: General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.  
 Minimum passing distance for a 2-lane road is currently under revision.  
 (Reference: NCDOT Roadway Metric Design Manual page 1-12, T-1)  
<sup>1</sup>K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters (in feet) of the vertical curve which will provide the desired sight distance.

4) *Superelevation*: Table 14 shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter of 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

**Table 14**  
**Superelevation Table**

Design Speed (kph)	Minimum	Radius of Maximum	e <sup>1</sup>
	e = 0.04	e = 0.06	e = 0.08
50	100	90	80
65	175	160	145
80	280	250	230
100	490	435	395

<sup>1</sup>e = rate of roadway superelevation, m/m (ft/ft)

Reference: NCDOT Roadway Design Manual, page 1-12, T-6 through T-8



### ***Intersections***

- 1) Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.
- 2) Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.
- 3) Offset intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters between survey centerlines.

### ***Cul-de-Sacs***

Cul-de-sacs shall not be more than one-hundred fifty (150) meters in length. The distance from the edge of pavement on the vehicular turnaround to the ROW line should not be less than the distance from the edge of pavement to ROW line on the street approaching the turnaround. Cul-de-sacs should not be used to avoid connection with an existing street or avoid the extension of an important street.

### ***Alleys***

- 1) Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivision unless necessitated by unusual circumstances.
- 2) The width of an alley shall be at least 6.0 meters.
- 3) Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the dead-end as may be required by the Planning Board.

### ***Permits For Connection To State Roads***

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the NCDOT.

### ***Offsets To Utility Poles***

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9.0 meters from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters from the face of curb.



### ***Wheelchair Ramps***

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations repairs correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

### ***Horizontal Width on Bridge Deck***

The clear roadway widths for new and reconstructed bridges serving 2-lane, 2-way traffic should be as follows:

- 1) Shoulder section approach:
  - a) Under 800 ADT design year; minimum 8.5 m width, face to face of parapets of rails or pavement width plus 3.1 m, whichever greater.
  - b) 800-2000 ADT design year; minimum 10.4 m width, face to face of parapets of rails or pavement width plus 3.7 m, whichever greater.
  - c) Over 2000 ADT design year; minimum width of 12.2 m, desirable width of 13.4 m width, face to face to parapets or rails.
- 2) Curbs and gutter approach
  - a) Under 800 ADT design year; minimum 7.3 m face to face of curbs.
  - b) Over 800 ADT design year; width of approach pavement measured face to face of curbs. Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 0.5 meters minimum, or greater if sidewalks are required.
- 3) The clear roadway widths for new and reconstructed bridges having 4 or more lanes servicing undivided two-way traffic should be as follows:
  - a) Shoulder section approach: Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 meters minimum, 3.1 meters desirable.)
  - b) Curb and gutter approach: Width of approach pavement measured face to face of curbs.

**Table 15**  
**Exact Metric Equivalents**

English Units	Metric Units
1 inch	equals 2.54 centimeters (cm)
1 foot	equals 0.30 meters (m)
1 mile	equals 1.61 kilometers (km)
1 acre <sup>1</sup>	equals 0.40 hectares (ha)

<sup>1</sup>1 acre = 43,560 ft<sup>2</sup>



**Table 16**  
**Exact English Equivalents**

<b>Metric Units</b>	<b>English Units</b>
1 centimeter (cm)	equals 0.39 inches
1 meter (m)	equals 3.28 feet
1 kilometer (km)	equals 0.62 miles
1 hectare (ha)	equals 2.47 acres

**Table 17**  
**NCDOT Metric Roadway Conversions**

<b>Lane Widths</b>		<b>Shoulder Widths</b>	
8 feet	2.4 m	1 foot	0.3 m
9 feet	2.7 m	2 feet	0.6 m
10 feet	3.0 m	4 feet	1.2 m
11 feet	3.3 m	6 feet	1.8 m
12 feet	3.6 m	8 feet	2.4 m
14 feet	4.2 m		





